



ANNUAL REPORT

ON THE

AGRICULTURAL EXPERIMENTS AND  
DEMONSTRATIONS

IN

ASSAM

FOR THE

YEAR ENDING THE 30TH JUNE 1918.



SHILLONG :

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## Annual Report of the Jorhat Agricultural Experiment Station for the year ending 30th June 1918.

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1. *Introduction.*—This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most rabi crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented with in culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of the raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years, in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about  $35\frac{1}{2}$  acres, of which 1.7 acres is a hola or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is hola land and the remainder high land.

The total area at present is thus  $59\frac{1}{2}$  acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. *Soil*.—The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth.

The following report is by Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

*Report on analysis of Jorhat Farm soil.*

	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No. 5(a).
1	2	3
A	Per cent.	Per cent.
<i>Soluble in Hydrochloric acid with 12 hours' digestion at 100°C.</i>		
Phosphoric acid ( $P_2O_5$ ) ... ..	0.025	0.020
Potash ( $K_2O$ ) ... ..	0.115	0.135
Lime ( $CaO$ ) ... ..	0.154	0.144
Magnesia ( $MgO$ ) ... ..	0.166	0.148
B		
<i>Soluble in one per cent. citric acid with 7 days' digestion.</i>		
Phosphoric acid ... ..	0.008	0.008
Potash ... ..	0.007	0.011
C		
Loss on ignition (organic matter and combined water) ... ..	3.26	1.84
Nitrogen ... ..	0.115	0.051
Calcium carbonate ... ..	0.048	0.018
Reaction ... ..	Acid	Acid.

*Physical constants.*

	Hygroscopic capacity.	Maximum water saturation capacity.		Minimum water saturation capacity.		
		Per cent. of water in saturated soil by weight.	Per cent. of water in saturated soil by volume.	Per cent. of water by weight.	Per cent. of water by volume.	
1	2	3	4	5	6	7
Surface soil ...	3.10	31.9	50.5	11.2	13.9	1.8
Sub-soil ...	...	30.0	50.0	7.2	9.1	1.19

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime is quite deficient in quantity.

Carbonate of lime has an enormous influence on a soil's welfare chemically, physically and bacteriologically.

Its effects on soil biological processes are in the right direction and very great; it also influences the texture of soils in a remarkable way, and is active in bringing into use the reserves of dormant plant food. Its presence in fair amount also ensures the most economical effect of any manuring given. Its absence forbids the use, for most cropping, of certain kinds of manures, unless liming be first restored to.

Any upland soil containing such small amounts of total lime and lime carbonate as are here present will most certainly respond markedly in the case of most cropping to applications of lime.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of a doubtful character and consists very probably of very old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one but in view of the absence in anything like adequate quantity of carbonate of lime,

conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

Turning to the physical constants, the hygroscopic capacity is low, and about what one would expect for this class of soil. It means that only water which is in excess of about 3 per cent. is available for crops, and plants are able to reduce the soil moisture content to somewhere about this figure before they begin to wilt. The top 6 inches of soil even during the cold weather normally contains a good deal more moisture than 3 per cent. when under a close standing crop, so that usually there is sufficient water for the crop's requirements.

As regards maximum saturation capacity, these soils agree quite well with quoted figures for similar soils in Europe, and suggest that the optimum proportion of water for the growth of the plant is about 13 to 16 per cent. A recent determination of soil moisture in the surface 6 inches of the soil of this farm in August, some few hours after rain, gave 17 per cent. water. Soil moisture conditions are therefore probably favourable for growth during the rainy season in normal seasons.

The figures for minimum saturation capacity are much lower than those cited (Hall. The soil page 69) for similar soils in Europe, and this is probably due to the lower content of humus which obtains in our soils. This is an extremely important figure in gauging a soil's power to retain a reserve of moisture for crops during dry periods.

The sub-soil is worse in this respect than the surface layer, suggesting that the incorporation of organic matter, if it can be buried sufficiently deep, will have a great ameliorating effect.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crop will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures. No amount or combination of the latter can ever make up the case of a crop like sugarcane for loss of fertility due to shallow cultivation and lack of "humus".

3. *Buildings, machinery, etc.*—The farm is equipped with a godown, combined office and rest house, Farm Manager's bungalow, clerk's and apprentices' quarters, cattle shed, Dutch barn, and is enclosed by "Ideal" wire fencing.

A Hornby oil engine and crushing mill capable of dealing with 1 ton cane per hour was installed in 1911 and has given every satisfaction since.

4. *Rainfall.*—The rainfall recorded during the growing period of the crops referred to is given with the normal rainfall below:—

Month.		Actual rainfall.	Normal rainfall.
1917 April	...	5.75	8.54
" May	...	6.66	9.26
" June	...	21.04	11.36
" July	...	16.29	14.76
" August	...	15.14	15.15
" September	...	11.91	9.18
" October	...	8.68	4.07
" November	...	1.03	0.69
" December	...	0.20	0.52
1918 January	...	0.07	0.93
" February	...	0.95	1.32
" March	...	7.67	3.90
Total	...	96.44	79.68



*Remarks.*—The rainfall was some 10 inches in excess of normal, but well distributed, ceasing with a heavy burst on 2nd November 1917. Nice showers fell in the second half of February which enabled us to plant all our cane in good time under nice soil conditions. The spring was colder than usual up to the end of April 1917, but May was hot and rainfall short.

The heavy rains of June and July kept temperature down, but temperatures ran high from August to October.

Cold weather crops were got in well on nice moisture, and did well for a time. The subsequent drought which lasted till February 25th, however, told against them and oats, pulses, etc., were poor in consequence.

5. *Experimental work.*—The work of previous years was continued and extended as follows:—

- I. Sugarcane experiments, varietal, manurial, and testing of new varieties.
- II. Soil investigations and manurial tests.
- III. Trials of new crops or new varieties.
- IV. Distribution of improved varieties of sugarcane.

6. *Sugarcane.*—This work includes the testing of varieties manurial experiments in the cane rotation, trials of different planting methods, and the distribution of the best varieties. Over 1 lakh of cuttings were sent out.

The cane made excellent growth throughout the year and the crops were big. Cold weather fogs, however, commenced early in November and persisted almost throughout the normal ripening season. Heavy wind storms resulted in a good deal of lodging and damage, and to aggravate matters a fungus disease "*Malanconium Sacchari*" appeared as the canes were ripening. This completely destroyed many canes; in some varieties the loss was estimated at from 15 to 20 per cent. of the total crop. It is feared that this disease was introduced in a newly acquired variety Java 247, which has since been entirely rooted out and burnt, and all possible steps taken to prevent a recurrence. Injury to other varieties by lodging and borers was probably the cause of their taking the fungus attack, as uninjured unripe canes are reported never to be attacked by this fungus.

Some of the cane yields are therefore lower than they would have been by some 15 to 20 percent, and the quality of the juice is also poorer as a result of the attack than usual.

7. *Sugarcane varieties. Ratoon cane.*—The following varieties planted in Block A in 1916 were ratooned:—B147, B376, Striped Mauritius, Kheri, Magh Magh sport, Barbadoes A and B-6450

plots of 1/10th acre of each variety being provided on both phosphated and non-phosphated area. The results of the plant cane crop appeared in paragraph 8 of last year's report.

The usual cultivation was given to the ratoons, the common manuring being 2,400 lbs. rape cake, supplying 100 lbs. nitrogen per acre, applied in three equal dressings.

The plots were harvested in February 1918. The results appear in Table I.

Of the older varieties Striped Mauritius and B-376 did well giving about 28 and 25 tons stripped cane per acre. B-147 ratooned badly as compared with previous years, though giving about 19 tons per acre. The following average figures are interesting :—

Variety.	Yield of cane per acre in lbs.	
	Season 1917-18.	Average yield for previous 4 years.
B-147 ratoon	42,400	51,640
Striped Mauritius	62,400	61,110
B-376 ratoon	55,800	52,810

There is thus some indication that B-147 is losing its ratooning capacity which is substantiated by field observations.

Of the newer varieties B-6150 gave a better crop than Barbadoes A, with much higher sucrose content and a purer juice, comparing very favourably with Striped Mauritius and B-376.

*Phosphated area.*—The average increase of cane per acre due to application of phosphate was some 3,460 lbs. or  $1\frac{1}{2}$  tons. The increase in the previous plant cane crop was 3 tons per acre in favour of the phosphate. Valuing the cane at 5 annas per maund (80 lbs.) this shows a total net profit of Rs. 23 per acre from the use of phosphate in the rotation for the two crops.

TABLE I.  
*Ratoon cane 1917-18. Block A. (Varieties).*  
 (Figures are per acre).

Plot.	Variety.	Plot area.	Cane.	Juice.	Expression : juice on calc.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose expressed in juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
1 } 1a }	B-147 "	"	Lbs. 44,760	Lbs. 28,040	Per cent. 61.2	Per cent. 15.02	Per cent. ...	...	Per cent. 87.8	Lbs. 4,212	The (A) plots were on the phosphated area.  Only partial analysis of this cane was made this year on account of the claims of other work at the Kanurup Farm.
2 } 2a }	Striped mauritius	"	Lbs. 30,600	Lbs. 25,400	Per cent. 63.3	Per cent. 14.90	Per cent. 1.00	87.1	86.3	3,785	
3 } 3a }	B-376 "	"	Lbs. 61,630	Lbs. 37,370	Per cent. 62.5	Per cent. ...	Per cent. ...	...	...	...	
4 } 4a }	B-147 "	"	Lbs. 60,230	Lbs. 37,550	Per cent. 61.6	Per cent. ...	Per cent. ...	...	...	...	
5 } 5a }	Striped mauritius	"	Lbs. 32,080	Lbs. 25,340	Per cent. 68.6	Per cent. ...	Per cent. ...	...	...	...	
			Lbs. 44,080	Lbs. 27,910	Per cent. 62.4	Per cent. ...	Per cent. ...	...	...	...	
			Lbs. 57,910	Lbs. 36,960	Per cent. 63.6	Per cent. ...	Per cent. ...	...	...	...	
			Lbs. 70,310	Lbs. 44,000	Per cent. 62.6	Per cent. ...	Per cent. ...	...	...	...	



8. *Sugarcane varieties. Plant cane. Block D.*—Following the usual rotation this block of cane was green-manured with cowpea (*vigna catiung*) in 1916 in preparation for cane, part of the block being dressed with 5 cwts. Stane's Flour Phosphate per acre before sowing this crop. At the same time, the whole block was given ground limestone at the rate of 1,600 lbs. per acre.

Rape was sown as a catch crop early in October 1916 and ploughed in while in flower in November. Both the cowpea and rape made much better crops on the phosphated area. The land lay fallow throughout the cold weather. Sugarcane was planted in February 1917, direct into the plots on nice moisture. The following varieties were tested against one another, Striped Mauritius, B-147, B-376, Barbadoes A, B-6450, B-3412, J-33a, J-247, Barbadoes B, Magh and Magh sport. Where sufficient planting material was available the varieties were planted on both the phosphated and non-phosphated areas. Common manuring was 40,000 lbs. cowdung per acre, half at planting and the remainder in two equal dressings at either earthing.

The crops all made remarkably good growth and proved on the average the heaviest we have recorded in spite of the attack of "*Melanconium Sacchari*" referred to in paragraph 6 of this report.

The results appear in Table II.

The figures for cane yield show that the average crop, despite the fungus attack, was a very big one, the average yield per acre for the whole of the varieties being some 33.4 tons per acre, which constitutes a record for this farm.

Thus Striped Mauritius gave 35.7 tons stripped cane per acre; B-376 gave 29 tons; B-147, 26.7 tons; Barbadoes A, 43 tons; B-6450, 32 tons; B-3412, 39.1 tons; J-33a, 36.6 tons; Barbadoes B, 35.6 tons; Magh sport 33 tons and Magh, the local variety only 24.4 tons.

Block D. Plant cane 1917-18. Varieties.

Variety.	Plot No.	Plot area.	Cane per acre.	Juice.	Expressed juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
B-147	1	14th	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Lbs.	
...	1a	"	55,610	23,520	68.0	16.03	0.56	9.51	90.2	6,176	The (a) plots were on the phosphate area.
Striped Mauritius	2	"	62,330	43,450	69.0	15.19	0.84	5.58	88.2	6,596	
...	2a	"	83,910	56,130	66.9	14.93	...	...	91.5	5,403	The phosphate plots were much more attacked by the cane borer than the non-phosphated ones mentioned in paragraph 6, than were the non-phosphated plots. The attack was apparently originated in a new plot, planted in the centre of the phosphate area, but which was subsequently uprooted and destroyed. The results of this variety do not appear in the Table.
B-378	3	"	75,700	51,800	68.4	14.75	0.83	5.73	88.8	7,537	
...	3a	"	71,880	46,979	65.3	13.90	0.87	6.31	89.9	6,229	
Barbados A	4	"	53,170	40,480	67.8	14.08	0.89	6.54	88.6	5,551	
...	4a	"	98,690	66,633	67.4	10.47	2.27	21.63	77.5	6,972	
Barbados A	5	"	93,740	64,080	68.3	15.18	2.37	23.23	74.1	6,523	
...	5a	"	73,130	21,700	70.7	15.61	0.70	4.49	89.8	8,068	
B-6459	6	"	70,420	48,100	68.3	14.90	0.93	6.41	87.2	7,023	
...	6a	"	87,690	61,880	70.6	11.50	1.92	16.69	79.4	7,116	
B-3412	7	"	81,970	53,060	64.7	13.06	1.36	10.41	81.7	6,990	
J-33a	8	"	70,530	53,090	67.5	12.40	1.67	13.66	81.4	6,968	
Barbados B	9	"	64,890	38,960	70.9	9.45	1.87	18.98	75.9	5,333	
Magh	10	"	74,060	40,360	69.6	13.01	1.10	8.45	84.8	6,420	
Magh Sport	11	"	...	...	...	...	...	...	...	...	

The following average figures are interesting :—

Variety.	Yield of cane per acre in lbs.	
	1917-18.	Average yield for 4 previous years.
B-147. Plant cane ... ..	59,770	54,255
Striped mauritius ... ..	79,805	63,088
B-376 ... ..	65,025	58,012
Magh ... ..	54,830	44,790
Magh sport ... ..	74,060	43,780

While the newer varieties Barbadoes A and B, B-6450, P-3412, and J-33a gave very high yields of cane, some of them failed to ripen their juice off properly, notably Barbadoes A and B and B-3412 which gave the highest yields of cane. B-6450 was the only one which approached the sucrose content of the older varieties B-147 and Striped Mauritius, etc.'

The highest yield of sucrose per acre in expressed juice was returned by Striped Mauritius with 3·5 tons sucrose followed closely by B6450 with 3·37 tons.

Some of these new varieties then have certainly not yet acclimatised themselves to our ripening season here. On the other hand, on the Kamrup Farm where the ripening season is much more favourable than at Jorhat, from analysis made last cold weather, these same varieties appear to ripen off their juice much more perfectly.

*Phosphated area.*—The phosphated plots in most cases showed a slight decrease in canes fit for milling as compared with the non-phosphated, but otherwise similarly manured plots, a decrease of 2·09 tons per acre on the average. This is explainable on the ground that J-247, the variety in which apparently the fungus disease referred to in paragraph 6 originated, was planted in the centre of the phosphated area, and was not planted in the non-phosphated block. It was observable, and confirmed by subsequent weighing, that the number of canes destroyed by the "Melanconium Sacchari" was much greater in the phosphated area than in the non-phosphated.

9. *Sugarcane planting experiment.*—*Plant cane.*—Commenced in Block D in 1917. Previous experiments had pointed to the conclusion that the disposition of a given number of cane setts per acre in the trenches at planting time influenced the crop. This experiment provides for testing the value of wide versus narrow trenches on the Java model, and also for testing the value of different disposition of the setts in both cases.

All trenches were 9 inches deep and 5 feet from centre to centre; in plots 1-4 they were 2 feet wide, while in plots 5 and 6 they were only one foot wide. Eight thousand setts per acre were planted in all plots. Other details are shown in Table III together with the results. The results are too close to permit of any deductions being drawn in regard to either the value of wide versus narrow trenches or the manner of disposition of the setts. It may be more than a coincidence however, that in all cases the planting of the setts in a single row up the middle of the trench gave a higher yield than by disposing them in two spaced parallel rows.

10. *New varieties of cane.*—Four new varieties Barbadoes B, J-33a, J-247 and B-3412 were given field plots this year for the first time. Their behaviour has been dealt with under paragraph 8. On present showing J-33a should make a very good cultivators cane.

Java Hebbal, B-1529 and a red sport of Striped Mauritius received from Coimbatore made a very miserable show in the nursery both as plant cane and ratoons, and have been discarded in consequence.

B-6450 is the most promising of the newer varieties up to date and looks like acclimatising quickly.

Barbadoes A and B-3412, while being very heavy croppers, do not appear to ripen off readily as yet, their juices being low in sucrose and purity.

A number of new varieties have been received in 1918 from the Imperial Sugarcane Expert and other sources and are being propagated in the nursery. These include Co. 1, 6 and 9; J-36, 39, 213; Ashy Mauritius and Mauritius 55, 90 and 131; D74; a red sport of Striped Mauritius from Kamrup; W. M. Nos. 1, 3, 4 and 2 others introduced by Mr. Maxwell into the Kamrup Farm from Java; White and Red Bombai; Manjav from Manjri; and 7 varieties from the Surma Valley.

We are looking for early ripening varieties and three of the above are said to ripen in 10-11 months.



TABLE III.  
Block D. Plant cane 1917-18. Planting experiment.

Variety.	Plot No.	Method of planting.	Plot area.	Cane per acre.	Juice.	Extraction juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity coefficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	3	3	4	5	6	7	8	9	10	11	12	13
Striped Mauritius.	1	Java trenches 3 feet wide and 9 inches deep, 5 feet from centre to centre, setts 8,000 per acre planted in a single row up centre of trenches.	1/2 x ...	69,750	Lbs. 44,700	Per cent. 64.1	Per cent. 14.67	Per cent. 0.63	6.38	88.0	6,558	
	2	Java trenches as in plot 1, but setts 8,000 per acre were disposed in the bottom of the trenches in three parallel rows 12 inches apart.	1/2 x ...	64,880	Lbs. 43,350	Per cent. 68.8	Per cent. 15.18	Per cent. 0.87	5.74	90.7	6,880	
	3	Duplicate of plot 1	1/2 x ...	67,110	Lbs. 45,350	Per cent. 67.6	Per cent. 15.26	Per cent. 0.85	5.63	89.7	6,918	
	4	Duplicate of plot 2	1/2 x ...	60,230	Lbs. 40,110	Per cent. 66.6	Per cent. 15.64	Per cent. 0.79	5.05	90.4	6,378	
	5	Java trenches 1 foot wide and 9 inches deep, 5 feet from centre to centre, setts 8,000 per acre disposed in double parallel rows 6 inches apart.	1/2 x ...	65,606	Lbs. 43,130	Per cent. 68.7	Per cent. 15.43	Per cent. ...	...	90.6	6,960	
	6	Java trenches as in plot 5, but setts disposed in a single row.	1/2 x ...	69,000	Lbs. 47,300	Per cent. 68.5	Per cent. 15.06	Per cent. ...	...	90.2	7,587	

11. *Soil investigations and manurial tests.*—The various experiments bearing on this work, mostly having reference to the treatment of sour soils, were continued. Now that my laboratory is completed, and soil investigations are again possible, it is hoped to modify and perhaps extend this work and to place it on a better footing in the near future.

The work includes:—

Block G—Liming experiment commenced 1909.

„ C—Liming and manurial experiment; also an experiment in the use of wood ashes, commenced 1911.

„ K—Experiments to ascertain the reasons underlying the beneficial effect of lime on the old red alluvium, and to test the action of various manures with and without lime, commenced 1912.

„ L—Ground limestone experiment, started 1913.

Blocks E, B, A, D—Experiments in the use of raw mineral phosphate in the sugarcane rotation initiated 1913, 1914, 1915 and 1916, respectively.

For previous details the reports for 1912—1917 may be consulted.

12. *Block G. Liming Experiment.*—Half this block was limed 9 years ago, and both sides are regularly and similarly cropped to see how long the effect of the single lime dressing will last. The cropping this year was jowar in the rains followed by matikalai, oats, gram and rape in the cold weather.

Jowar germinated all over, but very slowly on the unlimed section dying off very shortly after. On the limed side it made about an annas 8 crop.

The cold weather crops germinated all over, but died off within a few weeks on the unlimed section.

On the limed side the gram and rape persisted, but produced no grain, the oats and matikalai did better and yielded a small quantity of grain.

The effect of the lime dressing 9 years ago is thus still marked, though gradually diminishing.

13. *Block C, Lime and Manurial Experiment.*—This experiment, designed to run in the first instance for 6 years, finished its initial course last year. By that time each of the limed sections had received a total of 2 tons of slaked lime per acre either (a) as one initial application, or (b) as two equal triennial dressings, or (c) in six equal annual doses.

As regards cross dressings, each of the phosphated plots had a total of 1,440 lbs. bonemeal, *i.e.*, 240 lbs. annually, for 6 years. Each of the cowdung plots had been given a total of 48,000 lbs. cowdung, *i.e.*, 8,000 lbs. per annum for the 6 years.

It was considered desirable to continue this experiment for residual effect. In deciding on the lines of continuance it was considered that we should distinguish between—

- (A) manures used as soil treatment, *i.e.*, those used with a view to more or less permanently improve the soil for all cropping rather than supplying the immediate requirements of any particular crop. In this category we placed lime and bonemeal in view of the probability that the amount of either applied in the previous 6 years may be expected to influence cropping for some years to come, and also it is desirable to measure the residual effect of these two manures ; and
- (B) other manures, *e.g.*, cowdung, which are more transient or whose effect on the soil are not of such a permanent character. In a hot and humid climate such as ours green-manures would also have to be placed in this category we think.

It was therefore decided—

- (a) to apply no more lime or bonemeal for the present ;
- (b) to continue green-manuring one block once every four years ;
- (c) to continue the annual cross-dressing of cowdung on sub-plots C and D.

The cropping for 1917-18 was as follows :—

—	Kharif.	Rabi.
1	2	3
Non-green-manured block ... ..	Aus paddy ...	Oats.
Green-manured block ... ..	Cowpeas for green-manure.	„

Aus paddy should not have been sown on this land in view of our previous experience of the crop. The fact was that we had acquired a small quantity of a specially fine variety of aus paddy which it was desired to grow for seed purposes. It was sown in

lines 2 feet apart; subsequently it was attacked by rice hispa and other paddy bugs, and the resulting crop was in consequence so small and irregular that the yields are of no value.

Cowpeas did well all over except on plot 5A. On the plots cross dressed with bonemeal, *i.e.*, section B, the action of the bonemeal on the green crop was very favourably marked.

The best plots were plots 6, 7, 8, sections C and D. (See Table IV).

The crop was hoed in at the end of July.

As regards the rabi oats crop, in spite of the long drought after sowing, the limed sections made fair to good crops.

The records appear in Table IV.

*Lime dressings.*—An examination of the figures leads one to the conclusion that, as regards the differential lime applications, the evidence is, as last year, again in favour of the smaller, and more frequent dressings, *cf.*, plots 6, 7 and 8 the relative crops being respectively as 154 : 126 : 100, and also plots 2, 3 and 4, the relation being as 140 : 144 : 100. This has been the experience from the 5th year of the experiment to the seventh.

*Cross dressings.*—In regard to bonemeal, the figures furnish no evidence of the value of this manure to the oats crop. While on the green-manured block the bonemeal plots gave in the aggregate a slightly bigger crop than the plots which had no bonemeal, on the non-green-manured block the result was a small balance against the bonemeal.

Taken over the whole area the crop yielded by the 16 bonemeal plots is almost identical with that yielded by the remaining sixteen, the difference being less than 1 per cent.

*Value of organic matter.*—The great efficiency of organic manures is strongly emphasized in these results. The aggregate crop of the green-manured block is to that of the non-green-manured area as 129 : 100.

Similarly, for the whole area, the outturn of the 16 plots manured with cowdung is to that of the remaining 16 plots as 229 : 100.

The value then of organic matter is fully apparent, as indeed one would expect it to be in a dry season such as this was, when soils deficient in organic matter are apt to lose moisture so easily.

TABLE IV.  
Block C. *Seventh year of experiment, 1917-18.*  
(Figures are per acre) Oats grain.

	Non-green-manured Block.						Green-manured Block.					
	No lime.			Lime total 4,800 lbs., initially in 1911.			No lime.			Lime total 4,800 lbs., initially in 1911.		
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.	Plot 6.	Plot 7.	Plot 8.	Plot 9.	Plot 10.	Plot 11.	Plot 12.
1	2	3	4	5	6	7	8	9				
A. Nil	Nil	400	420	390	Nil	470	530	305				
B. Bonemeal 240 lbs. per acre annually 1st to 6th years.	Nil	350	380	280	10	520	430	505				
C. Bonemeal 240 lbs. <i>plus</i> cowdung 8,000 lbs. per acre annually in 1st to 6th years.	150	890	780	680	710*	1,060	920	630				
D. Cowdung 8,000 lbs. annually per acre in 1st to 6th years.	70	860	990	680	470*	1,155	740	740				

\* Both these plots unfortunately received some lime by mistake during heavy rain from the heavily limed plots immediately on their left in the early years of the experiment.

14. *Wood ashes experiment.*—Five plots receive respectively 5, 10, nil, 15 and 20 maunds (1 maund=80 lbs.) wood ashes per acre per annum. Half of each plot is cross-dressed annually with cowdung 100 maunds per acre. The experiment was commenced in 1911. Cropping this year was cowpea green-manure followed by oats.

The yields of oats were as under :—

					Oats, grain.
1					2
Plot 1	{ 5 maunds ashes per acre ... ..				Nil.
	{ 5 " " " plus cowdung ... ..				165 lbs.
Plot 2	{ 10 " " " ... ..				Nil.
	{ 10 " " " plus cowdung ... ..				210 "
Plot 3	{ Nil ... ..				Nil.
	{ Cowdung ... ..				Nil.
Plot 4	{ 15 maunds ashes per acre... ..				98 "
	{ 15 " " " plus cowdung ... ..				434 "
Plot 5	{ 20 " " " ... ..				375 "
	{ 20 " " " plus cowdung ... ..				435 "

This is essentially a cultivator's experiment, and shows what can be done towards soil improvement on the old alluvium with wood ashes, especially if supplemented by cowdung. If wood ashes were regularly conserved and applied there can be no possible doubt that cold weather crops, now so conspicuously absent generally in the Assam Valley, could be profitably grown.

15. *Block L. Ground limestone.*—Commenced 1913 on very poor, infertile, newly broken up 'chapri' land. The scheme consists of 6 plots of 1/3rd acre each in two series of 3 plots each. One series Section A is cultivated shallow with country implements; the other section B being worked deeper with English implements. This ensures a deeper application of the limestone on section B than on section A, one of the chief objects of the

experiment being to elucidate the effects of incorporating lime with the soil to varying depths, using a variety of cropping. Ground limestone was applied as follows in 1913 :—

Sections A and B	{	Plot 1—15 maunds limestone per acre.
		„ 2—Nil.
		„ 3—30 maunds limestone per acre.

For further details of the scheme see previous years' reports.

The cropping this year, the 5th of the experiment, was a mixed crop of maize and rahar. This same mixture was grown 2 years ago in the 3rd year of the experiment and gave a verdict then in favour of the deeper application of lime, as opposed to the evidence of the wheat and oats crops which have always responded best to its shallower application.

The present crop, maize and rahar, was sown on the 28th April 1917 in drills 4 feet apart. Germination was good all over, and the young plants were early thinned out, maize and rahar alternating in the rows. The crop was kept well cultivated and clean throughout. As opposed to the results of 2 years ago with the same mixed crop, this year section A, shallow cultivation, gave the better results. The seedlings on the unlimed plots of both sections soon began to die out, the maize going first.

The crop led all through on the shallow cultivated section A, otherwise improving with increase in the limestone application on either section. It was well marked throughout the growing period that the difference in favour of section A over section B in the case of the rahar was not nearly so marked as it was in the case of the maize crop. It would appear that rahar is clearly more tolerant of soil acidity than maize, as the latter entirely died out on both unlimed plots, whereas a few stunted rahar plants did struggle through and produced some grain on these same plots. The maize was harvested in August 1917, while the rahar was left for seed, being harvested at the end of April 1918. It is unfortunate that the maize cobs were badly damaged by crows during ripening; the relative weights of grain are thus not reliable. Counts were however made of the number of cobs produced per plot, and again the total crop of each plot was cut and weighed after the cobs were harvested, and the experiment must be judged by these figures, which fully confirm observations made during the growing period.

The rahar flowered late in the cold weather but the seed set badly; during the continued damp weather of March and April the crop was almost entirely ruined by insects or rotted by rain. Though no figures for the rahar crop are available, careful observations made left no doubt that the crops followed the same order as is recorded for the maize.

The figures for the maize crop appear in Table V.

In this the fifth year of this experiment then, *i.e.*, in 1917, we have a reversal of the results obtained with the same crops in the third year, 1915, in regard to the advantage or otherwise resulting from a deeper or shallower lime application. It was clear for both crops, from germination to maturity, that the shallower application gave the better crops this year. Two years ago it was no less clear that the advantage lay with the deeper application. How shall we explain this? In the absence of any recent laboratory examination of the soils of these plots, which has been impossible up-to-date, I cannot advance any adequate explanation. It may, however, be supposed that a repressive degree of acidity will sooner become re-established in the surface soil of section B than in that of section A. While two years ago the soil acidity of plots 1 and 3 in either section, was presumably sufficiently far removed from the danger point to allow of the deeper cultivation acting beneficially, with lapse of time it may well be that at the present time the acidity of the surface soil of the deeply cultivated section is nearer to the danger point for these two crops than is desirable, and that any possible favourable effects of deeper cultivation do not counterbalance this return to acidity.

The teaching of this experiment up to date at any rate appears to be that in the four or five years following the application of ground limestone, (in amounts which do not exceed 100 per cent. of the soils lime requirements to a depth of 3—4 inches), to soils whose surface and sub-strata are both sour, for most farm crops it will pay to keep the limestone well up to the surface by not cultivating too deeply; more especially this applies to shallow rooting crops, *e.g.*, oats and to certain others which root more deeply but which are very susceptible to soil acidity in the seedling stage, *e.g.*, wheat.

This would not appear to apply however with equal force to certain other crops, *e.g.*, rahar, partly on account of deep rooting habits and a comparative tolerance to acidity in its early stages.

The following point also appears to be perfectly clear, that, within the limits of this experiment, the more completely the lime requirements of the soil are satisfied to any given depth the better the growth and development of the crop.

Further, in deciding the depth to which it is advisable to incorporate a given application of limestone with the soil by cultivation, the factor of the susceptibility of the crops to be grown to acidity in the seedling stage is a more potent one than that of depth of rooting.



Finally it is not by any means improbable that had we originally adopted as our maximum dressing of limestone such an amount as would have been equal to 100 per cent. or even 150 per cent. of the soils lime requirement to a depth of 9 or 10 inches, different results might have followed. The investigation of this lies in the future, and will be taken up as time and opportunity permit.

TABLE V.  
Block I. Ground limestone experiment. Figures are per plot of 1/3rd acre.

Plot.	Treatment.	Section A (shallow cultivation).			Section B (deep cultivation).			Remarks.
		Total number of maize cobs per plot.	Percentage of cobs bearing grain.	Weight of maize stalks.	Total number of maize cobs per plot.	Percentage of cobs bearing grain.	Weight of maize stalks.	
1	2	3	4	5	6	7	8	9
1	15 maunds limestone per acre.	698	19.6	526	104	1	150	Section A plots are cultivated only 3 to 4 inches deep.
2	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Section B plots are cultivated some 6 to 8 inches deep.
3	30 maunds limestone per acre.	1,258	38.8	1,174	900	29.5	924	The result is that any giving dressing of lime becomes incorporated in Section B with twice the volume of soil that it becomes mixed with in Section A.

16. *Block K. Experiment to ascertain the early functions of Lime.*—Commenced in 1912, this experiment was continued in its sixth year. For previous results reference may be made to the Jorhat Farm reports for 1913 *et seq.* and to memoir No. 9, Volume III, Chemical Series of the Memoirs of the Department of Agriculture in India, entitled "Studies of an acid soil in Assam." The experiment is being carried on with a view to throwing further light on some aspects of the use of certain manures, both with and without lime on sour soils.

The evil effects of the continued use of superphosphate, but especially of sulphate of ammonia, on our sour soils, in the absence of lime, are becoming more strongly marked each year. Even green-manure crops, which in the early years of the experiment suffered little if at all from the use of these two manures without lime, are now obviously being adversely affected.

Again though the use of sulphate of ammonia along with lime was at first beneficial, signs are not wanting that unless the lime dressings are renewed, its effects soon begin to be adverse.

Unless the use of lime is periodically resorted to, in our experience on the sour old alluvium of the Assam Valley, it is distinctly not only profitless but detrimental to the soil to use sulphate of ammonia as a source of nitrogen.

Further though this action of sulphate of ammonia is masked to some extent when used as the source of nitrogen in a complete mixture of artificials, it appears from our experiments to be only a matter of time before its baneful effects appear, *i.e.*, if used more or less continuously.

With lapse of time those plots which annually receive cowdung, without any lime, are beginning to yield fair crops of oats. Other experiments on this Farm also go to show that with good cultivation and especially drainage, and the use of bulky organic manures, *e.g.*, green-manures and cowdung regularly, a wonderful improvement can be effected in our sour soils even without the use of lime; however there can be no doubt that it pays well to use lime which has such a favourable effect both on the condition and drainage of many of our sour soils.

The experiment emphasizes as time goes on the lasting value of the basic forms of phosphoric acid, *e.g.*, basic slag and certain raw mineral phosphates.

17. *Blocks E, B, A, and D. Mineral phosphate experiment in the sugarcane rotation.*—An area of about 1 acre in each of the four blocks in the cane rotation, has been dressed with flow phosphate with a view to observing its effect on the various

crops of the rotation. The phosphate is applied in the 4th year of the rotation previous to sowing the green-crop of cowpeas. It will be repeated every fourth year at the same point in the rotation. The rotation is as follows:—Cane in the 1st and 2nd years; a green-crop of dhaincha followed by oats in the 3rd year; a green-crop of cowpeas followed by a catch crop of rape ploughed in, in the fourth year.

It will naturally be some years before very much information will be available; at least we should work through two and preferably three complete rotations on each block before attempting to generalise. So far the rotation has been completed for the first time on two blocks only, *viz.*, blocks E and B. The results for block E appeared in paragraph 17 of last year's report, a net profit of Rs. 39-6 per acre for the rotation being recorded.

On block B, in the year of application, the phosphated area gave an increase of 650 lbs. rape seed per acre over the non-phosphated area, increase valued at Rs. 36. During the first and second years of the rotation there was a slight decrease per acre for the two crops of cane of some 6,500 lbs. per acre valued at Rs. 25-8; (the area to which the phosphate was applied is very difficult to drain properly and from the point of view of the cane crop was much the worst part of the block); in the third year the phosphated area gave an increase of 126 lbs. oats grain per acre valued at Rs. 4-8, neglecting the value of the increased weight of straw obtained also.

The total value of the increase is Rs. 40-8 minus Rs. 25-8 = Rs. 15, which almost exactly balances the cost of the phosphate (Rs. 15-12); this, neglecting the value of the increase in oat straw, leaves us as we were in regard to the first rotation on this block.

In paragraphs 7 and 8 of this report will be found an account of the effect of the phosphate on the ratoon and plant cane crop of the year under report.

Block E was the area to get phosphate this year; this is its second application the first dressing having been given in 1913. The crops of cowpeas and rape following made very much quicker growth and bigger crops on the phosphated area.

18. *Extension area.*—*Block M.*—The indigo of the previous year, after seed harvest, was ratooned as a green-crop and ploughed in; it made a nice even green-crop on the limed area, but did nothing on the unlimed side.

Khasi matikalai was taken as the rabi crop; owing to the cold weather drought it made a poor crop on the limed side, and no crop at all on the other. It was intended to use this block for

trials of various phosphates in a rotation; from the patchy appearance of the crops so far grown, it appears to be very doubtful whether it will ever be suitable for experimental work of an accurate nature.

*Blocks O, N, and P. Sugarcane for distribution.*—Part of Block O, and the whole of N and P were under cane for distribution some 1,16,000 cane cuttings of B-376, B-147 and Striped Mauritius being sent out during the spring.

The remainder of block O, and block R were under cowpeas followed by matikalai. The yields were as follows:—

—				Grain per acre.
1				2
Block O (dressed with limestone 30 maunds per acre in 1913).				550 lbs. matikalai.
Block R (unlimed) ... ..				43 lbs. „

19. *Other crops.*—Block B was green-manured with dhaincha following two years of cane. Oats was taken as the cold weather crop but only yielded poorly on account of the cold weather drought, the outturn being 426 lbs. grain per acre for the phosphated area as against only 300 lbs. for the non-phosphated area.

*Cowpea for seed.*—Two varieties selected from many in previous years were grown in Block II for seed.

Yields were as follows:—

—				Seed per acre.
1				2
"Jorhat Brown" ... ..				890 lbs.
"New Era" ... ..				514 lbs.

These yields would have been larger still but for an attack of pod borer which destroyed a large part of the early crop.

*Kitchen garden.*—A number of crops were grown on small plots of about 1/50th acre for observation, comparison and selec-

tion, e.g., cowpeas (varieties); soy beans (varieties); ground nuts (varieties); dhaincha and sunn hemp for seed; java, natal indigo, etc.

				Calculated yields per acre; grain
1				2
Soy beans	{ Shillong variety	...	...	1,228 lbs.
	{ Farm "	...	...	1,098 "
Ground nuts	{ Farm seed ...	...	...	984 "
	{ Virginia ...	...	...	640 "
	{ Big Japan...	...	...	376 "
	{ Raipur ...	...	...	362 "
	{ Dhaincha ...	...	...	993 "
	Java, natal indigo	...	...	2,600 "

Some of these crops were not so good as usual on account of insect attacks and depredations by rats, the ground nut crop in particular was very largely ruined by rats before the nuts were ripe.

*Pulse crops.*—The following pulses were tried as cold weather crops on plots of about 1/20th acre:—soy beans, musuri, khesari, kulthi and gamhar.

They were sown towards the end of October on nice moisture but the subsequent drought went against them. The results were as follows:—

				Calculated yield per acre; grain.
1				2
Khesari	...	...	...	636 lbs.
Musuri	...	...	...	835 "
Kulthi	...	...	...	160 "
Soy bean	...	...	...	165 "
Gamhar	...	...	...	Failed entirely.

There appears to be good ground for believing that much better results may be expected from these pulse crops by earlier sowing, say mid September. Experiments will be continued with these and other pulse crops. There would appear to be room for a considerable extension of the cultivation of pulse crops in the Assam Valley.

20. *Fodder crops*.—Some attention has been paid during the year to the question of fodder crops suitable for this valley, which is a matter of some urgency, though it is rather much to hope that cultivators will take up seriously the question of fodder supply. We have previously tried various fodder crops, *e.g.*, jowar; maize and cowpeas, *euchloena luxurians*, etc., but up-to-date without making any impression on the cultivator.

This year experiments have been commenced with three other crops, *e.g.*, guinea grass, rhodes grass and kheri sugar-cane. Plots of these fodders have been laid down for comparison. Guinea grass was planted up from roots on the 18th June and at the time of writing, August 15th, is ready for first cutting. It appears to be full of promise as a supplier of a large amount of excellent fodder.

Seed of rhodes grass, which is giving such very excellent results on the Military Dairy Farms of Western India, having supplanted guinea grass there, was obtained from Poona. This was grown in seed beds and has only recently been planted out.

Kheri sugarcane was planted up closely in lines in the spring and has already given two cuttings of fodder.

Figures will appear in next year's report. At present the information at our command is insufficient to make any definite recommendations.

21. *Orchard*.—Fruit trees comprise 16 lichis, 6 mangoes, 1 custard apple, 3 sapota, 5 guavas, 1 pomelo, 1 plum and 3 papaya, besides several varieties of plantain, and 12 young orange trees planted during the year. Most fruited well except the mangoes. There are four varieties of pine-apples:—Ceylon, Kew, Queen and Spanish. All fruited well. About 1,000 suckers of the Ceylon and Kew varieties were sent out during the year.

22. *Receipts and Expenditure*.—The receipts from sale proceeds amounted to Rs. 2,585-2. This is somewhat less than last year, chiefly on account of the much lower price obtaining for gur during the crushing season.

The total expenditure including cost of establishment and charges on capital amount amounted to Rs. 11,457-13-1.

23. *Establishment*.—This consists of a Manager on Rs. 100—10—200; clerk on Rs. 25—1½—40 and a peon on Rs. 8. The number of apprentices on the Farm during the year was ten,

two of whom Nozirul Islam Bora and Lalit Nath Kakati proceeded to the Agricultural College, Sabour, in June. Four more completed their training, Umar Ali, Bideshi Ram Dutta, Kesav Narayan Dutta, and Bogai Ram Bora; the three former were appointed temporary demonstrators on 1st November 1917, 1st June 1918, 29th April 1918, respectively.

The following new apprentices joined, Jadab Chandra Das Talukdar and Seyadur Rahman from Goalpara district; Mir Dayam and Puna Ram Keot from Darrang district.

JORHAT:	}	A. A. MEGITT, <i>Agricultural Chemist to the Assam Administration.</i>
<i>The 15th August 1918.</i>		



ANNUAL REPORT OF THE UPPER SHILLONG AGRI.  
CULTURAL EXPERIMENT STATION FOR THE YEAR  
ENDING THE 30TH JUNE 1918.

1. The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road,  $5\frac{1}{2}$  miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, i.e., about 900 feet higher than Shillong town. The total area of the farm is 366.67 acres, of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose, it has recently been converted into firm pasture ground by deepening the stream which drains the valley and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a pronounced reddish colour and of great depth. In a small portion of the cultivated area the soil is black owing, it is believed, to the existence of some mineral compound. At the bottom of the valley, a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the upper portion of this soil is a matted mass of half-decayed grass-roots.

In point of quality the soil of the farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of an exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter, the growth of vegetation is entirely suspended.

2. The main objects for which the station is maintained are the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Khasi Hills, the breeding of improved strains of milch cattle suitable for this tract and the cultivation of fodder crops for their up-keep. Fodder experiments have been tried from time to time, but having proved abortive, they have one after another dropped

out of the programme of the farm. Very little experimental work beyond the potato trials is done at present on the farm, and if we leave out the cattle and the fodder crops grown for them, the station may be looked upon more as a seed-growing farm than one devoted to experimental work.

3. The following table gives the rainfall during the official agricultural year under report :—

*Rainfall.*

				Actual, 1917-18.	Normal.	Number of rainy days, 1917-18.
1				2	3	4
1917.						
July	...	...	...	8.66	17.75	18
August	...	...	...	9.58	15.67	15
September	...	...	...	11.35	11.06	18
October	...	...	...	12.66	7.55	9
November	...	...	...	0.56	1.27	1
December	...	...	...	...	0.18	...
Total for six months				42.81	53.48	61
1918.						
January	...	...	...	0.15	0.29	1
February	..	...	...	0.45	1.02	3
March	...	...	...	0.33	2.25	1
April	...	...	...	5.18	4.48	7
May	...	...	...	14.55	8.83	20
June	...	...	...	25.64	20.04	23
Total for six months				46.30	36.91	55
Total for year				89.11	90.39	116

These 12 months really cover parts of two different agricultural seasons, as, on the plateau of the higher Khasi Hills the cropping season commences in February and ends in November.

The autumn rainfall being rather less than usual was suitable for hay-making and harvesting of the principal crops. Early frosts stopped the growth of winter potatoes and caused this crop to be a light one.

A severe drought in spring checked germination of the potato sets and a period of heavy rainfall in May and June produced conditions favourable to potato disease, with the result that this year's outturn is likely to prove smaller than even the last year's crop.

The other crops will give a smaller outturn than usual. The upland rice, maize and raishan crops are moderate but the Job's tears crop is poor. Owing to the extremely heavy down pour of rain in May and June not only were the crops injured on some of the steep hillsides but considerable damage was done by surface soil being washed away.

4. The work done during the year included :—  
Summary of work.

- (1) Trials of different varieties of potatoes.
- (2) Growing potatoes for seed.
- (3) Trials of new crops.
- (4) Fodder crops.
- (5) Cattle breeding.
- (6) Distribution of seeds, implements, etc.

5. Of the 22 varieties grown in 1916, Windsor Castle 1909 was given up, and two other varieties Arran Chief and King of Potatoes 1916 have been added. The total number under this experiment in 1917 was thus 23 varieties. Where it was possible, each variety was planted in duplicate plots of  $\frac{1}{10}$ th acre each. All the varieties were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 240 gallons per acre, applied in two equal doses.

Statement showing the average yield per acre on duplicate plots for the last ten years.

Variety.	1917.	1918.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last six years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
1. King of Potatoes	Tons. 4.07	Tons. 9.20	Tons. 6.38	Tons. 8.0	Tons. 6.84	Tons. 6.49	Tons. 7.37	Tons. 4.82	Tons. 3.31	Tons. 11.7	Tons. 7.32	
2. Magnum Bonum (1909)	... 5.23	9.25	6.77	7.85	6.07	8.51	5.90	4.88	3.23	10.16	7.78	
3. King Edward VII	... 3.65	7.35	4.81	6.17	4.30	4.58	6.0	2.68	3.31	9.97	5.19	
4. Elba Nainital	... 4.12	8.71	5.43	6.93	6.39	6.11	5.78	4.36	4.10	10.7	6.88	
5. Khasi Round	... 2.89	6.89	4.98	4.22	4.51	4.00	4.35	3.40	3.76	9.35	4.48	
6. British Queen (1907)	... 4.75	9.12	7.36	7.19	5.69	6.66	6.66	3.40	...	...	6.76	
7. Up-to-Date	... 4.91	9.78	6.12	7.02	6.84	6.53	6.81	3.30	...	...	6.91	
8. Magnum Bonum (1919)	... 4.95	8.91	4.83	6.24	5.72	8.22	...	...	...	...	6.49	
9. Windsor Castle ( " )	... 6.49	10.12	6.10	8.75	4.73	7.19	...	...	...	...	7.24	



The same 23 varieties are under experiment in the present year. As in former years, 50 tubers of each variety were selected at random, cut open, and examined for signs of disease. The following table gives the result of the examination in the last eight years :—

Varieties.	Number of diseased tubers out of 50 examined.								
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	
1	2	3	4	5	6	7	8	9	
King of Potatoes ...	12	nil.	nil.	nil.	1	6	3	nil.	
Magnum Bonum (1908) ...	6	4	2	4	2	nil.	1	nil.	
King Edward VII (1906) ...	18	8	4	6	5	4	1	nil.	
Khasi Nafital (1908) ...	48	16	8	4	4	8	nil.	1	
Khasi Round (1900) ...	4	8	6	10	6	6	10	3	
British Queen (1906) ...	12	...	6	4	2	8	2	nil.	
Up-to-Date (1909) ...	4	32	16	4	1	6	4	1	
Magnum Bonum (1912) ...	...	...	6	6	2	2	1	6	
Windsor Castle (1913) ...	...	...	4	3	2	10	1	nil.	
British Queen (1912) ...	...	...	4	4	3	6	1	1	
Four Ball (1912) ...	...	...	6	5	1	10	1	1	
Imperator (1912) ...	...	...	22	3	3	4	6	nil.	
Stirling Castle (1915) ...	...	...	...	...	...	...	10	nil.	
Epicure (1915) ...	...	...	...	...	...	...	5	1	
Magnum Bonum (1916) ...	...	...	...	...	...	...	5	nil.	
Dover Castle (1915) ...	...	...	...	...	...	...	4	1	
Up-to-Date (1915) ...	...	...	...	...	...	...	1	1	
King of Potatoes (1916) ...	...	...	...	...	...	...	...	nil.	
Windsor Castle (1915) ...	...	...	...	...	...	...	2	3	
Edinburgh Castle (1916) ...	...	...	...	...	...	...	3	nil.	
Acquisition ...	...	...	...	...	...	...	...	3	
Balmoral Castle ...	...	...	...	...	...	...	5	5	
Aran Chief ...	...	...	...	...	...	...	...	3	

Potato disease caused by *Phytophthora Infestans* is often responsible for considerable damage to the potato crop in the Khasi Hills. This year the damage to the farm crop was greater than usual, owing to growth being delayed by an early drought, which was followed by rather heavy rainfall in May and June, and an

early appearance of potato blight. Preventive spraying is as thoroughly and systematically carried out on the farm every year as weather conditions permit.

In the present year part of the crop was sprayed twice with Bordeaux mixture, at 120 gallons per acre each time, the balance being sprayed once at the same rate.

Notwithstanding this treatment, growth ceased early, and the crop is yielding a smaller outturn than in the previous year.

Seven new types of potatoes raised from seed in 1914 from the variety Flour-ball have been grown since that time.

Although a certain amount of selection work has been done on these varieties they do not yet seem to be pure. Single plants will be selected in the present year for the purpose of procuring pure strains.

Twenty lots of seed were obtained in February 1916 from St. Andrew's University, through the kindness of Donald Ferguson, Esq., of Dhamai Tea Estate, Sylhet, Honorary Correspondent of the Department. Half of each lot of seed was sown in boxes on 20th February 1916, and the remaining half was sown similarly on the 19th March 1916. Out of twenty lots, numbers four and twenty failed to germinate. The others grew satisfactorily, and the seedlings were planted in the field on the 15th March 1916.

Two lots of seed produced only one plant each, and as one of these plants failed to form any tubers, the total number was reduced to nineteen. Two lots were destroyed by insects and the remaining seventeen have given widely varying yields in the past two seasons. Calculating the yields to a uniform amount of one seer of seed of each variety, the outturn has varied from 4 to 56 seers. These varieties are being grown on a larger scale in the present year and it is probable that several good varieties will be found among them.

*Potato manurial experiment.*—An experiment designed to shed some light on the respective manurial values of rape cake and bonemeal for the potato crop was carried out in 1916 and 1917 and is being repeated in the present year. This experiment was put down in duplicate on a series of plots of King of Potatoes, and a similar duplicate experiment was carried out with

Magnum Bonum. The seed rate was 987 pounds per acre. The manures used and the yields obtained per acre in 1917 are shown in the accompanying table :—

1	2	3	4	5	6	7
Manures used per acre.	Cowdung. 5·5 tons.	Cowdung 5·5 tons, rape cake 823 pounds.	Rape cake 823 pounds.	Bonemeal 823 pounds.	Cowdung 5·5 tons, bonemeal 823 pounds.	Rape cake 823 pounds, Bonemeal 823 pounds.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
King of Potatoes ...	2·53	4·45	·96	1·19	3·45	1·64
Magnum Bonum ...	1·13	2·99	1·16	1·52	2·09	1·85
Total ...	3·66	7·42	2·12	2·71	5·54	3·49
average yield per acre ...	1·83	3·71	1·06	1·35	2·77	1·74

Bonemeal and rape cake were used not because they were considered the most suitable for the potato crop, but because they are practically the only manures, other than cowdung, which are known to the cultivators of the Khasi Hills.

From the yields obtained it would seem that, under the conditions prevailing on the Upper Shillong Farm, while rape cake is more effective than bonemeal as a supplementary dressing with cowdung, yet when used alone, bonemeal gives much better results than the rape cake. These manures are again under experiment in the present season and the results will appear in next year's report.

6. Six varieties of potatoes were grown during 1917 for the production of seed. These varieties were King of Potatoes, Magnum Bonum, Up-to-Date, Windsor Castle, British Queen and Imperator. The crop was planted in March and harvested in August. The total area planted was 7·4 acres as against 3·1 acres in 1916. The manures used were, as in previous years, 5·5 tons of cowdung, and 823 pounds of rape cake per acre. The crop was sprayed once with



Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows:—

Variety.	Area, in acres.	Total yield, in tons.
1	2	3
King of Potatoes ... ..	2.85	7.08
Magnum Bonum ... ..	2.075	6.29
Up-to-Date ... ..	1.325	4.14
Windsor Castle ... ..	1.15	4.62
British Queen (19 9) ... ..	.25	.74
Imperator ... ..	.25	1.03
Total ... ..	7.4	23.9

The average yield per acre amounted to a little over 3.2 ton against 5.5 tons in 1916.

For the present year about 8 acres have been planted in March with the same 6 varieties. The crop is still in the ground. The demand from the plains for seed potatoes grown on the Shillong Farm is extending rapidly. In order to meet this increased demand, the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is an insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1916 to cultivate an extra area of potatoes under the *Jhum* system and this has been continued since. In that year an area of 16½ acres was planted on the farm lands according to this system, in 1917 10½ acres, and in the current year 10 acres have been so planted.

An agreement was made with Khasi cultivators to carry out this work. The terms were that the farm should provide the land and the seed, and the cultivators should do the work and return to the farm one and a half times the seed supplied. The cultivators also undertake to sell, at bazar rates, whatever additional quantity of seed may be required. In 1917, the farm supplied for this purpose 2.92 tons and in return received 4.77 tons. This included .36 tons received as payment for the work of spraying the crop with Bordeaux mixture, which was done by the farm workers.

In the present year 10 acres are being cultivated under a similar agreement. The farm supplied 3.78 tons and it is expected that the return will be a over 6.06 tons. The total quantity

of potatoes available for disposal last year (1917) was 58.39 tons made up as follows :—

	Tons.
Farm grown crop taking summer and winter crop together	33.03
Seed returned by the <i>jhum</i> growers ... ..	4.77
Purchased from <i>jhum</i> cultivators ... ..	20.59
<b>Total ... ..</b>	<b>58.39</b>

This quantity was disposed of as follows :—

Sold to Khasi cultivators ... ..	11.31
Supplied to Gauhati Seed Depot and other places in the province through the Agricultural Officers ...	19.45
Sold direct from the farm to officials and private individuals outside the Khasi Hills ... ..	1.17
<b>Total quantity supplied for seed ... ..</b>	<b>31.93</b>
Used on the farm and <i>jhum</i> area for planting ... ..	20.77
Dryage and rottage and feed of cattle ... ..	5.69
<b>Total ... ..</b>	<b>58.39</b>

The price charged to Khasi cultivators for seed potatoes supplied was the market price for table potatoes for the time being and varied last year between Rs. 2-8-0 and Rs. 2-12-0 per maund.

A small quantity of damaged potatoes and potatoes which were unsuitable for seed were fed to the farm stock.

The seed potatoes sold consisted of 9.58 tons of King of Potatoes, 10.72 tons of Magnum Bonum, 3.30 tons of Up-to-Date, 3.85 tons of Windsor Castle and the balance of the minor varieties.

7. It is the custom in many parts of the Khasi Hills to interplant the potato crop with maize. This makes a good combination, but when the time arrives for spraying, the maize plants are in a soft, succulent stage and are easily injured

An experiment to test the effect of Bordeaux mixture on young maize plants.

by the Bordeaux mixture. As a consequence many of the cultivators refuse to spray their potatoes because they hold that the injury to the maize more than counterbalances the benefit to the potatoes.

An experiment was carried out on the farm to test this point.

A plot of  $\frac{1}{10}$  acre of maize was sprayed with Bordeaux mixture and a corresponding plot of the same area was left unsprayed. The mixture did undoubtedly burn the soft young leaves to some extent, but fresh leaves rapidly shot out and the plants quickly recovered.

When harvesting the maize, the produce of both plots was weighed with the result that the unsprayed plot gave a yield of 2 maunds 13 seers while the sprayed plot gave a yield of 2 maunds 25 seers showing that the temporary check had not reduced the yield of crop.

8. Experiments on the warping of rice land have been carried out on wet rice land for the past few years. As the results were unsatisfactory they have been discontinued in the present year and the land is now being utilized for trials of lime and bonemeal.

The following two series have been laid down :—

*First series, Lime experiment.*—Duplicate plots of  $\frac{1}{10}$ th acre each have been manured with lime at the rates of 10 maunds, 20 maunds and 30 maunds per acre, respectively. Four plots remain as control.

*Second series, Lime versus Bonemeal.*—Duplicate plots of  $\frac{1}{10}$ th acre each have been manured with bonemeal at 3 maunds per acre and another series of duplicate plots with lime at 30 maunds per acre. The rest remain as control plots.

For both experiments, the seed was sown early in May at the rate of 40 seers per acre. When the seed was about to germinate heavy rainfall set in and consequently the germination was unsatisfactory.

*Naga Hills rices.*—Two varieties of new rice from the Naga Hills, viz., Rhelaw and Thavier, have been introduced for the first time at the farm. These were sown at about the same time on land of  $\frac{1}{4}$  acre. Germination was satisfactory.

9. *Buckwheat.*—This crop has been recently introduced into the district by Nepalese settlers, and although the returns have not been very large, it seems to have possibilities on the Khasi Hills, as the cost of cultivation is so small. When the seed is sown immediately after the

New crops.

potatoes have been dug, no extra cultivation is required. On the farm this course was followed satisfactorily for the first two years of the experiment. In 1915, the crop grew very well until the frosts set in, which unfortunately was rather early in the season. Afterwards little growth was made and the yield was disappointing. The 1916 crop met with a similar fate and was not worth harvesting. Immediately after digging up the potatoes one acre of land was sown with Buckwheat in the middle of July 1917. The crop grew fairly well but as it did not set its flowers uniformly, only about 1 maund 20 seers of seed was gathered. The outturn would have been much greater if the crop had ripened properly.

*Rhubarb*.—This crop was first planted in 1912, on a plot of land about  $\frac{1}{10}$ th of an acre in extent. A further plot of  $\frac{1}{10}$ th of an acre was planted in 1915. The land was manured with cowdung in the winter of 1917-18, at the rate of 11 tons per acre.

The plants grew vigorously and a total of 440 pounds of stalks was sold realising Rs. 55.

The plants are continuing to grow well.

*Strawberries*.—In September 1916 an additional plot of  $\frac{1}{20}$ th acre was planted with two varieties of strawberries obtained from the fruit garden, Shillong. These plants grew well and in October 1917 another  $\frac{1}{10}$ th of an acre was planted with the suckers of these two varieties.

All the plots were manured last winter with cowdung and bonemeal at the rate of 11 tons and 247 pounds, respectively. The strawberry plants are growing well but, owing to the severe spring drought, they flowered late in the season and most of the fruits were destroyed by heavy rains in May.

Only about 8 pounds of fruits have been picked and sold during the year, and the return therefrom was Rs. 5-12.

*Other fruits*.—A few of the trees on the farm bore fruits. These were sold and realised the following sums:—

					Rs.	a.	p.
Apples	...	...	...	...	50	13	9
Peaches	...	...	...	...	0	14	6
Chestnuts	...	...	...	...	24	9	6
Plums	...	...	...	...	0	10	0

Fodder crops. 10. The following fodder crops were grown during the year :—

Names of crops.	Area sown.	Cost of cultivation.	Outturn of green fodder.
1	2	3	4
	Acres.	Rs. a. p.	Tons.
Maize ... ..	8.62	261 1 8	33.95
Job's tears ... ..	12.67	376 8 9	37.6
Jhum area ... ..	5 Approx.	...	9.47
Grasses ... ..	...	...	16.0
Total ... ..	26.29	637 10 0	44.79

The maize crop gave a fair yield. Job's tears did well in the *jhum* area, but the farm crop was poor.

The whole of this fodder (44.79 tons) was made into ensilage. From this quantity of green material 39.95 tons or 80 per cent was recovered as ensilage of good quality.

The total cost of silage was Rs. 782-6-5, made up of cost of cultivation Rs. 637-10-0, cost of carrying the fodder, chopping and packing in the silo Rs. 144-12-5.

The proportion of loss through decay around the sides of the pit in which the ensilage was made, was smaller than in the previous year. The cost per ton of silage was Rs. 19-9-0 as compared with Rs. 19-6-0 in the previous year.

*Raishan* (*Paspalum Sanguinale*)—has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. *Raishan* was grown on an area of 12 acres and the produce was made into hay and fed to the cattle during the winter months. In addition to *Raishan*, about 1 acre of soybean and 1.6 acres of hill paddy were grown and the product mixed with the hay.

A total amount of 19.62 tons of hay was fed during the year. The cost was Rs. 638-12-0 or a little over Rs. 32-4-0 per ton of hay as compared with Rs. 34 in 1916.

The quality of this fodder was good, and all was eaten by the cattle.

attle breeding.

11. The following table shows the number of cattle in the herd of 30th June 1918 :—

Descriptions.	Montgomery.	Montgomery × Ayreshire.	Montgomery × Patna.	Montgomery × Patna × Bhutia.	M × P × B × P.	M × P × B × P × P.	M × Bhutia.	Patna.	Bhutia (B).	P × B.	P × B × P.	P × B × P × P.	P × B × P × P × P.	P × Khasia (K).	Total on 30th June 1918.	Total on 30th June 1917.	Total on 30th June 1916.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
single bulls ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	2	Are being used as plough cattle.
3 (3 years and over.)	...	1	...	...	...	...	...	1	...	2	...	...	...	2	6	3	4	
3 (2 to 3 years) ...	1	...	...	...	...	...	...	3	...	1	4	...	...	...	9	7	3	
1 (1 to 2 years) ...	...	...	...	...	...	...	...	5	...	...	1	...	...	...	6	6	9	
(under 1 year) ...	...	...	2	2	1	2	...	2	...	1	...	...	...	...	10	6	8	
3 (2 to 3 years) ...	...	...	...	...	...	...	...	8	...	1	1	...	...	...	10	10	9	
(above 3 years) ...	...	...	...	...	...	...	...	3	...	1	1	...	...	...	5	1	...	
1 (1 to 2 years) ...	...	...	...	...	...	...	...	3	...	1	1	...	2	...	7	12	6	
(under 1 year) ...	...	...	2	2	3	2	1	1	...	2	1	1	...	...	14	9	12	
" ...	...	...	...	...	...	...	...	13	1	6	5	7	...	...	32	29	25	
all on 30th June 1918.	2	1	4	4	3	4	1	39	1	8	14	14	3	2	100	...	...	
all on 30th June 1917.	1	...	...	...	...	...	...	40	1	9	14	15	4	2	...	86	...	
all on 30th June 1916.	...	...	...	...	...	...	...	38	1	9	14	13	1	2	...	...	78	

In addition to the above, there were three Hindustani and 8 Chasi bullocks. The total number of cattle was therefore 111 against 97 on the corresponding date of last year.

Two young bulls, one a Montgomery and the other an Ayreshire × Montgomery crossbred of 2½ and 3 years old respectively, were purchased for breeding purposes from Pusa Farm during the year.

The demand for bulls bred at the farm still far exceeds the supply. During the past year 5 bulls and 2 heifers were sold. These consisted of one young Patna × Bhutia bull and 2 Patna Bhutia heifers which were sold locally, one Patna bull was sold to the proprietor of the National Dairy, Shillong, one to the Habiganj Municipality, one Patna × Bhutia bull supplied to the Karimganj Farm, and one Patna × Bhutia bull sold to a tea garden Manager in the Assam Valley.

The total yield of milk during the year amounted to 3,487 gallons, out of which about 15 gallons were fed to calves and the remainder was sold at the rate of 14 lbs. for a rupee.

The cost of maintenance of the herd amounted to Rs. 3,015-1-3 against Rs. 3,712-9-8 in the previous year. The income from the sale of milk amounted Rs. 2,101-6-6 against Rs. 1,854 5 6 and the value of the cattle sold to Rs. 223-0-0 against Rs. 327-0-0 in the previous year.

The half English Patna cattle and the progeny of their cross with Khasi and Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacity these cattle stand head and shoulders above any cattle on this side of India.

After many years of work we have got together a fine stock of milk cattle, the like of which is not to be seen within many hundred miles of Shillong, and which promises to improve further by selection and crossing. It would be a comparatively easy matter to increase the herd so as to make it possible for us to sell cows and heifers to the public. There is a great demand for female stock bred at Upper Shillong but we cannot afford to sell any at present. Some of our cows might easily fetch Rs. 200 or more, if offered for sale.

The cost of maintaining the herd is still high. It has been reduced considerably in recent years, and it would seem that still further reduction is possible. It might be possible to reduce the expenditure by separating the cows from the rest of the herd and maintaining them purely with a view to profit.

That the Upper Shillong cattle are being more and more appreciated is evident from the growing desire of cow owners in the Shillong Station for the services of the bulls bred on the farm.

The present herd of Patna cattle is far superior to the cattle of the province, and it would undoubtedly be advisable to maintain this breed if that were possible. Several attempts have been

made to obtain young bulls from the Patna district, but owing to the indiscriminate breeding in that district in recent years, it has been so far found impossible to procure bulls of the desired type.

The Montgomery bull which was purchased from the Roman Catholic Mission in the previous year has done good service to the herd. His progeny are stronger and healthier than the young stock we have had for the last few years.

It would be a great mistake to allow the Shillong herd to become mixed by indiscriminate crossing and arrangements are heretofore being made to keep the original Patna strain as pure as possible. This may be done by getting a bull from the Patna district or by keeping one of the best of our young bulls as a stud animal.

12. The following were the seeds and plants supplied to agriculturists during the year :—

Distribution of seeds  
and plants.

	Tons.	Number.
Seed potatoes ... ..	31.93	...
Rhubarb roots ... ..	...	24
Strawberry plants ... ..	...	510
Pear grafts ... ..	...	42
Fig cuttings ... ..	...	2
Chestnut seedlings... ..	...	15
* Oilcake for manure ... ..	1.80	...

\* This was not sold direct from the farm but was recommended and procured for the cultivators.

13. Mr. Harrick Singh continued in the position of Farm Manager during the year. U Shetro Mohan Jyrwa occupied the position of Farm Clerk with effect from the 16th August 1917 in place of U Bendromoney, deceased.

Two apprentices, Glosion Singh and Sedro Singh, have continued their apprenticeship during the year. In addition to these two apprentices one Khasi and one Garo candidate apprentices are being entertained. These young men work with the labourers and are paid at the ordinary rates.



14. The total receipts, including the value of seed potatoes used for demonstration purposes in the province, were Rs. 3,444-12-0 against Rs. 4,516-12-6 in previous year.

The sale of milk produced Rs. 2,001-6-6, the sale of cattle Rs. 226, while potatoes sold direct from the farm realised Rs. 543-13-0, and in addition, potatoes to the value of Rs. 457-9-3 were supplied for demonstration purposes throughout the province. In addition 20.53 tons of seed potatoes to the value of Rs. 1,199-4-6 were purchased from the *jhum* crops grown by Khasi cultivators on the farm and supplied for the plains districts.

The total expenditure for the year amounted to Rs. 14,455-10-11 against Rs. 14,014-7-9 in the previous year. The details are as follows :—

			Rs.	a.	p.
Establishment	...	...	2,643	14	10
Petty construction	...	...	2,808	14	0
Feed of cattle	...	...	2,649	10	9
Seed, plants and manures	...	...	513	3	7
Wages of farm labourers	...	...	4,486	14	8
Petty repairs	...	...	724	5	3
Purchase and repair of furniture	...	...	10	0	0
Service postage and telegrams	...	...	20	0	0
Unspecified charges	...	...			
Purchase of cattle	...	...	130	7	6
Total	...	...	14,455	10	11

The increase in expenditure was due to two items, *viz.*, (1) a sum of Rs. 1,500 spent on erecting a new cow-shed and new quarters for the apprentices, and (2) a sum of Rs. 1,308-14-0 spent on erecting a permanent wire fence.

CAMP KARIMGANJ,

The 10th August 1918.

J. W. MCKAY,

Deputy Director of Agriculture, Assam.

ANNUAL REPORT OF THE FRUIT EXPERIMENT STA-  
TION, SHILLONG, FOR THE YEAR ENDING  
THE 30TH JUNE 1918.

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1. *Introductory*.—The Fruit Station commenced work in October 1912: planting was commenced in the spring of 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong. The elevation is about 5,100 feet. The total area of the grant is 57.41 acres, of which about 26 acres is suitable for fruit growing: 24 $\frac{3}{4}$  acres have been planted.

2. *Lower Garden*.—No extension to this block has been made since 1913-14. The planted area is 4 $\frac{1}{4}$  acres in grounds of 6.13 acres: the fruit trees are planted 15'  $\times$  15' diagonally. The soil of this block varies from light sandy loam lying above stone to heavier loam continue to improve in growth and yield—James Grieve, Kerry Pippin, Rymer, Bismarck, Peasgood's Nonsuch, Devonshire Quarrenden, Crimson Bramley, Bramley's Seedling, Lane's Prince Albert. The following varieties yielded sparsely:—Red Juneating, Mr. Gladstone, Warner's King, Scarlet Nonpareil, Alfriston, Yellow Ingestre. Of the others Ribston Pippin, Cox's Orange Pippin, Hounslow Wonder, Hector MacDonald, Cox's Golden Drop, Golden Reinette bore a few fruit; and Mannington Pearmain, Barnack Beauty, Coronation, Wealthy, Roundway Magnum Bonum, Fearn's Pippin, Rosemary Russet, Newton Pippin did not bear fruit. On the lighter soil only the stronger growing varieties have succeeded, *viz.*—Encore, Bramley's Seedling, Crimson Bramley, Newton Wonder, Lady Sudely, Norfolk Beauty, Potts Seedling, Peasgood's Nonsuch, Alfriston, Lane's Prince Albert, Allington Pippin, Red Victoria, Kerry Pippin, Rymer. Of the varieties planted in place of ones of weaker growth that failed, Rev. W. Wilks, Worcester Pearmain, Bismarck, William Crump, Syke House Russet, Ardcairn Russet, Upton Pyne, Bens Red, promise best: the other varieties planted last year, *viz.*, Grenadier, Star of Devon, Charles Eyre, Lord Derby did not bear fruit.

The Pear trees suffered from the drought in March and April and put on very little new growth. Of the Bush-trees Fertility, St. Swithin, and Fondante Thirriot bore good crops for the size and age of the trees. As far as can be now judged, Fertility is

a great bearer and should be useful for market : St. Swithins an early variety is a prolific bearer, but is small and a poor keeper : Fondante Thirriot is a large white-fleshed pear that promises well for market. Madame Treyve, Durondeau, Beurre d' Amanlis, Emile d' Heyst bore fruit for the first time.

The following Espalier trained trees bore well :—Fondante d' Automne, medium size, flesh very tender and deliciously sweet : Marguerite Marillat—very large, uneven in outline, which did not ripen well this year, William bon Chretien—large melting and of strong musky flavour. [This well known fruit, whose name is freely adopted for any pear, was raised by a school master named Stair of Aldermaston about 1770. In that county it is still called "Stair's Pear", it took its name "Williams" from its distributor, a nurseryman of Turnham Green. On its introduction to America it was again renamed after its importer Mr. Bartlett.] Louise Bonne of Jersey—medium size, a delicious melting white-fleshed pear.

The Cherry trees suffered badly from the drought, and flowering late only a few set on the "Kentish" trees. The "Peregrine" was the only variety of the Peaches that ripened well : first class fruit was picked from the trees from 17th June to 5th July. The "Kestrel" trees bore a good crop, but incessant rain from the 7th to 15th July spoilt them as they were ripening. The 2 exquisite Peach trees bore well for the first time, the fruit ripening at the end of July. The fruit is yellow-fleshed freestone of poor quality compared to the earlier varieties. The other varieties flowered late owing to the drought, and yielded only a few undersized fruits.

The 3 varieties of Plum trees left in this garden for further experiment on light soil, viz., Deniston's Superb Gage, Belle de Louvain, Belgian Purple bore only a few fruit. One of the Lanzley Bullace trees bore a big crop of dark purple culinary fruit. This variety was raised by Messrs. Veitch (Farleigh Damson X Early Orleans Plum) and introduced in 1902. It is evidently, as described by the raisers, of great fertility and promises to succeed in this climate. The "Merryweather's Damson" trees bore well and the fruit is all the raisers—Messrs. Merryweather and Sons, claim for it ; it could readily be mistaken for a late plum until tasted : although the size is so much above that of the largest Damson grown, the true flavour of the Damson is retained. The Giant Himalaya Berry of California and the Blowers are the best of the varieties of Blackberries and the King's Acre Berry the best of the Hybrid Berries. None of the fruit came to perfection owing to the excessive rain in July, when they were

ripening. The Raspberries showed no improvement and have been discarded. White la Versailles White Currants fruited and further trials will be made with this variety. The Black Currants transplanted to shady sites have put on good growth but have not fruited. The land has been kept in good cultivation during the year. The lighter soil was again found to be infested with cockchafer grubs necessitating removing the soil round the trees to destroy them. A great many were also killed when the garden was deep hoed. During May and June the cockchafer beetles were caught in thousands by lamp light after dark. Calyx spraying with Arsenate of Lead solution was done, but this may not be the remedy for the grub in the Apple, which Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Pusa, has discovered is the larva of a weevil, an insect that is found on the trees from the time the trees flower, until the mid season fruit ripens. Mr. Bainbrigge Fletcher's report is awaited with interest, as the control of this pest is of the greatest importance in an Apple Orchard. There is also a brown weevil that attacks apple shoots. A boring insect, probably *Batocera rubus*, is very destructive to Fig trees and although grubs are destroyed as noticed, the damage done eventually kills the tree. There are a great many sucking insects that do damage which will be difficult to control when the trees grow bigger: at present they are caught by hand and destroyed.

3. *Upper Garden*.—The area planted is  $20\frac{1}{2}$  acres, of which  $10\frac{1}{2}$  acres was planted in 1914, 2 acres in 1915,  $\frac{1}{2}$  an acre in 1916,  $5\frac{1}{4}$  acres in 1917,  $2\frac{1}{4}$  acres in 1918. It is divided into 6 blocks, viz. :—

*Top block*.—Area  $1\frac{3}{4}$  acres planted in 1914 with Bush Apple trees  $15' \times 15'$  diagonally.

*North block*.—Area  $1\frac{1}{2}$  acres planted in 1914 with Standard Apple trees  $34' \times 34'$  diagonally, interplanted with Bush Apple trees  $17' \times 17'$ .

*South block*.—Area  $5\frac{1}{4}$  acres planted with Standard Apple trees  $30' \times 30'$  diagonally, interplanted with Bush Apple, Pyramid Pear, Cherry and Plum trees  $15' \times 15'$ ,  $\frac{3}{4}$  acre planted in 1914,  $\frac{1}{4}$  acre in 1915,  $\frac{1}{2}$  acre in 1916,  $2\frac{1}{4}$  acres in 1917, 1 acre in 1918.

*East block*.—Area  $8\frac{1}{4}$  acres; 7 acres is planted with standard Apple trees  $34' \times 34'$  diagonally, interplanted with Bush Apple trees  $17' \times 17'$ ;  $5\frac{1}{2}$  acres planted in 1914,  $1\frac{1}{2}$  acres planted in 1915. The remaining  $1\frac{1}{4}$  acres was planted in 1918 with Standard Pear trees  $25' \times 25'$  diagonally.

*East block extension.*—Area  $2\frac{1}{2}$  acres planted in 1917 with Standard Apple trees  $30' \times 30'$  diagonally, interplanted with Bush Apple trees  $15' \times 15'$ .

*West block.*—Area  $1\frac{1}{4}$  acres, planted with Standard Pear trees  $25' \times 25'$  diagonally, interplanted with Bush Pear trees  $12' 6" \times 12' 6"$ ; 1 acre planted in 1914,  $\frac{1}{4}$  acre in 1915.

The soil of the Upper Garden is a good loam of about 12 inches depth lying on a red sub-soil. Small plots have a hard pan sub-soil about  $2\frac{1}{2}$  feet from the surface. The whole of the planted area has been terraced with stone and banks. It has successfully prevented the denudation of the soil by rainfall.

The following statement shows the varieties of the Apples and Pears grafted in 1916 and 1917 :—

Varieties and Stock.	North block.		Top block.		East block.		West block.	
	1916.	1917.	1916.	1917.	1916.	1917.	1916.	1917.
1		3	4	5	6	7	8	9
<b>APPLES GRAFTED ON CRAB STOCK.</b>								
Bismarck ...	...	245	...	...	40	31	...	...
James Grieve ...	...	827	...	...	73	111	...	...
Kerry Pippin... ..	...	88	...	...	58	76	...	...
Lane's Prince Albert ...	...	...	...	...	15	29	...	...
Rev. W. Wilks ...	...	70	...	104	7	12	10	...
Stirling Castle ...	...	91	...	...	4	3	...	...
Red Victoria... ..	...	...	...	...	7	46	...	...
Crimson Bramley's Seedling.	...	...	...	...	24	36	...	...
Bramley's Seedling ...	...	...	...	...	20	28	...	...
Ariston ...	...	...	...	...	60	131	...	...
Bess Rod ...	...	...	...	...	25	56	...	...
Rival ...	...	...	...	...	46	60	...	...
Domino ...	...	...	...	...	55	65	...	...
Norfolk Beauty ...	...	83	...	...	...	...	...	...
Total ...	...	1,404	...	104	410	687	10	...

[illegible]

The following varieties of Apples in this garden have so far yielded best of the Bush trees:—James Grieve, Lane's Prince Albert, Upton Pyne, Bismarck, Rev. W. Wilks, Domino, Sturmer Pippin, William's Favourite, Kerry Pippin, Peasgood's Non-such, Lady Sudely, Encore, Bramley's Seedling, Newton Wonder, Charles Ross, Alfriston, Boston Russet, Royal Snow, Wadhurst Pippin, Ecklinville Seedling, Allington Pippin, William Crump, Irish Peach, Lord Grosvenor, Jefferson.

A few varieties of the Standard trees fruited for the first time; the trees have put on good growth. The following varieties of Pears fruited:—Fertility, Princess, Marguerite Marillat, William's bon Chretien, Doyenne d' Ete, Charles Ernest, Dr. Jules Guyot, Durondeau, Beurre d' Amanlis, Colmar d' Ete, Belle Julie, Fondante Thirriot. The trees have put on a better growth than the Lower Garden ones, and the site of the West Block appears to be favourable: the trees are too young to judge as to quality and yield; only the stronger trees were allowed to set a few fruit and these were promising. None of the English Plums bore fruit and growth was poor; the American varieties—Shiro, Gold, Omaha have grown well and bore a few fruits of good quality. None of the Orange trees have yet borne fruit. The whole area of this garden has been kept well cultivated, and the trees have put on very satisfactory growth. The Strawberry crop owing to the drought was a failure. New beds of "Royal Sovereign" have been planted in the South Block. Pruning commenced on the 7th January and was finished on the 12th February. The deep hoeing was finished on the 10th January. Two and quarter acres was added to the planted area this year. The East extension was planted with American and Kashmir Pear trees, and the South extension with Kashmir Apple trees. The whole of the planted area has been fenced with wire fencing.

The following trees are in Nurseries for future planting:—

Description.	South Block 1915 and 1916 trees.	South Block 1917 trees.	East Block 1915 trees from Kashmir.	East Block 1915 and 1916 trees.	Total.
1	2	3	4	5	6
Standard Apple trees ...	175	37	159	260	631
Bush " " ...	...	65	...	...	65
Standard Pear " ...	25	12	1	...	38
Sweet Chesnut ...	6	...	...	...	6
Peccan Nut ...	9	...	...	...	9

The establishment consists of an Overseer on a monthly salary of Rs. 25, 2 Khasi Apprentices, and Khasi Malis on a monthly salary of Rs. 15 each. All have worked well and take great interest in their work.

4. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted :—

Size of fruit trees.	Variety.	Planted 1914-15.					Planted 1913.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	East extension.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Trees	James Grieve ...	59	77	144	53	...	44	383	Bush.
	Boston Russet ...	...	2	13	...	...	...	14	
	Bens Red ...	...	...	10	10	...	9	29	
	Alfriston ...	...	...	29	1	...	8	37	
	Egremont Russet ...	10	...	...	8	1	...	19	
	Annie Elizabeth ...	...	...	20	...	...	...	20	
	Claygate Pearmain ...	8	...	...	10	...	...	18	
	Lord Hindlip ...	...	...	10	...	...	...	10	
	Mannington Pearmain ...	8	...	...	8	2	4	20	
	Winter Queening of Kent ...	...	...	10	...	...	...	10	
	Pineapple Russet ...	...	...	...	9	...	...	9	
	Edward VII ...	...	...	8	...	...	...	8	
	Red Juneating ...	6	...	...	2	...	10	18	
	Flower of Kent ...	...	...	8	...	...	...	8	
	Cornish Pine ...	...	11	...	...	...	...	11	
	Tower of Glamis ...	...	...	...	...	6	...	6	
	Winter Banana ...	...	...	...	...	3	...	3	
	Wolf River ...	...	...	...	...	3	...	3	
	Chelmsford Wonder ...	...	...	...	...	6	...	6	
	Byford Wonder ...	...	...	...	...	10	...	10	
Buddy ...	...	...	...	...	6	...	6		
Ormead Pearmain ...	...	...	...	...	6	...	6		
Hambleden Deux ans ...	...	...	...	...	3	...	3		
Belle de Pontome ...	...	...	...	...	3	...	3		
Barnack Beauty ...	...	...	...	6	8	5	19		



Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1912.	Total number.	Description.	
		Upper garden.								
		Top block.	South block.	East block.	North block.	East extension.	Lower garden.			
1	2	3	4	5	6	7	8	9	10	
Apple trees	Coronation	...	...	6	4	...	5	15	Bush.	
	Wealthy	...	...	...	4	...	6	10		
	Foltham Beauty	...	...	10	...	...	...	10		
	Norfolk Beauty	...	8	33	...	10	...	10		61
	Sanspareil	...	...	2	...	...	...	...		8
	Guelph	...	...	1	...	...	...	...		1
	Peacemaker	...	...	1	...	...	...	...		1
	Roseberry	...	...	1	...	...	...	...		1
	Christmas Pearmain...	...	...	10	...	...	...	...		10
	Yorkshire Beauty	...	5	...	...	1	...	...		6
	Kings Acre Pippin	...	...	6	...	...	...	...		6
	Crimson Bramley	...	13	...	18	...	...	5		33
	Royal Snow	...	...	...	10	...	...	...		10
	Bramley's Seedling	...	18	...	15	...	...	14		44
	Kings of Tompkins County.	...	1	...	8	2	...	...		11
	Houblon	...	...	...	6	...	...	...		6
	Roundway Magnum Bonum.	...	6	...	...	...	...	2		8
	Wellington	...	...	...	5	...	...	...		5
	Lanc's Prince Albert	...	14	2	17	...	10	11		54
	Upton Pyne	...	1	3	6	...	...	...		10
	Devon Queen	...	4	1	2	...	3	...		10
	Renown	...	...	4	...	...	6	...		10
	Stirling Castle	...	10	...	10	...	...	...		20
	Golden Russet	...	...	...	6	...	...	...		6
	Charles Ross	...	10	...	10	...	11	...		31
	Bismarck	...	...	1	17	8	...	10		46
	Rymer	...	6	...	...	...	...	...		6
	Warner's King	...	...	...	...	...	...	11		11
	Thomas Rivers	...	10	...	...	...	...	...		10
	Grenadier	...	...	2	14	...	...	3		19
	Rev. W. Wilks	...	19	...	6	...	...	6		31
	Houmalow Wonder	...	...	1	20	...	...	6		27

Species of fruit tree.	Variety.	Planted 1914-18.					Planted 1913. Lower garden.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	East extension.			
1	2	3	4	5	6	7	8	9	10
	Newton Wonder ...	15	...	21	...	...	16	53	
	Red Victoria ...	...	4	11	...	3	10	33	
	Potts' Seedling ...	4	...	5	...	...	10	19	
	Hector McDonald ...	...	...	20	...	...	10	30	
	Emperor Alexander ...	...	9	...	...	...	...	9	
	Sandringham ...	...	...	...	...	6	...	6	
	Rengemont ...	...	...	...	...	6	...	6	
	Hamblings Seedling...	...	...	...	...	6	...	6	
	Galsva ...	...	...	...	...	6	...	6	
	Baron Wolsely ...	...	...	...	...	6	...	6	
	Loddington Seedling ...	...	...	...	...	6	...	6	
	Parroquet ...	...	...	...	...	6	...	6	
	Domino ...	13	...	...	...	...	...	13	
	Rival ...	...	...	16	...	12	...	28	
to 1700	Wadhurst Pippin ...	10	...	...	...	...	...	10	Bush.
	Court Pendu Plat ...	6	...	6	...	...	...	12	
	Ecklinville Seedling ..	4	...	4	...	...	...	8	
	Early Red Margaret ...	...	...	10	...	...	...	10	
	Gascoyne's Scarlet ...	4	...	5	...	...	...	9	
	Spitzenberg ...	...	...	6	...	...	...	6	
	Braddicks Nonpareil...	5	...	...	...	...	...	5	
	White Nonpareil ...	10	...	...	...	...	...	10	
	Barrmann's Reimette...	6	7	8	...	4	...	26	
	Fitmaon Pineapple	10	...	...	...	...	...	10	
	Brownlee's Russet ...	10	...	...	...	...	...	10	
	Sturmer Pippin ...	6	6	16	...	...	20	47	
	Cardinal ...	...	...	9	1	...	...	10	
	Emmett Early ...	...	3	14	...	8	...	25	
	Langley Pippin ...	...	...	10	...	...	...	10	
	Wagener ...	...	...	9	...	...	...	9	
	Williams' Favourite...	10	...	...	...	...	...	10	
	Scarlet Nonpareil ...	...	...	10	...	...	12	22	

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913.	Total number.	Description.		
		Upper garden.									
		Top block.	South block.	East block.	North block.	East extension.	Lower garden.				
1	2	3	4	5	6	7	8	9	10		
Apple trees	Lord Burghley	...	1	...	...	...	4	2	7	Bush.	
	St. Everard	...	...	6	...	...	4	...	10		
	Beauty of Bedford	...	...	4	...	...	7	...	11		
	Reinette dorée de Heusinger.	...	10	...	...	...	...	...	10		
	Coe's Golden Drop	...	...	...	...	...	...	6	6		
	Cox's Orange Pippin...	...	7	...	...	...	...	23	30		
	Kerry Pippin	...	...	10	16	...	...	10	36		
	Golden Reinette	...	...	...	...	...	...	6	6		
	Peasgood's Nonsuch...	...	...	...	25	...	...	14	39		
	Fearn's Pippin	...	...	...	12	...	...	6	18		
	Lady Sudeley	...	...	...	20	...	...	10	30		
	Devonshire Quarrenden	...	...	...	...	...	...	17	17		
	May Queen	...	...	10	...	...	...	...	10		
	Royal Jubilee	...	...	10	...	...	...	...	10		
	Missing Link	...	...	1	...	...	...	...	1		
	Roseberry	...	...	1	...	...	...	...	1		
	Crawley Beauty	...	...	1	...	...	...	...	1		
	Mrs. Phillimore	...	...	...	...	...	6	...	6		
	Lord Grosvenor	...	...	...	...	...	6	...	6		
	Blue Pearmain	...	...	...	...	...	4	...	4		
	Jefferson	...	...	...	...	...	7	...	7		
	Star of Devon	...	...	...	...	...	20	6	26		
	Yellow Ingestre	...	...	...	...	...	...	6	6		
	Upton Pyne	...	...	...	...	...	25	6	31		
	Ardsair Russet	...	...	7	5	1	11	6	29		
	Allington Pippin	...	...	16	5	...	...	4	25		
	William Crump	...	...	10	19	...	11	6	46		
	Worcester Pearmain...	...	...	...	...	...	...	6	6		
	Herring's Pippin	...	4	6	3	...	...	52	1		68
	Beauty of Bath	...	...	5	5	...	...	...	1		11
	Ellison Orange	...	...	...	...	...	...	16	1		17
	Ribston Pippin	...	...	4	...	...	...	...	6		10
	Charles Eyre	...	...	...	3	...	...	10	7		20

species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	East extension.			
1	2	3	4	5	6	7	8	9	10
	Syke House Russet ...	...	...	...	...	...	6	6	} Bush.
	Spring Ribston Pippin ...	...	...	8	...	...	...	8	
	Mr. Gladstone ...	...	...	6	...	...	5	11	
	Golden Spire ...	...	14	...	...	9	...	23	
	Rosemary Russet ...	...	...	6	...	...	6	12	
	Duke of Devonshire ...	...	6	...	...	...	...	6	
	Early Peach ...	...	10	...	...	...	...	10	
	Newton Pippin ...	...	2	8	...	...	6	16	
	American Mother ...	...	9	...	...	...	...	9	
	Encore ...	...	...	18	...	...	4	22	
	Irish Peach ...	...	6	...	...	...	...	6	
	Lord Stradbroke ...	...	...	...	...	6	...	6	
	Total ...	340	317	782	142	358	432	2,581	
apple trees	Encore ...	...	6	...	...	...	...	6	} Standards.
	Crimson Bramley ...	...	5	3	10	...	...	18	
	Rymer ...	...	...	...	...	...	8	8	
	Bramley's Seedling ...	...	...	6	12	...	...	20	
	Court of Wick ...	...	...	5	...	3	...	6	
	Irish Peach ...	...	...	...	6	...	...	6	
	Northern Greening ...	...	...	...	...	...	8	8	
	Norfolk Beeding ...	...	...	...	6	...	...	6	
	Newton Wonder ...	...	4	21	...	...	...	26	
	Stirling Castle ...	...	...	5	1	...	5	11	
	Allington Pippin ...	...	...	...	...	...	4	4	
	Annie Elizabeth ...	...	...	...	...	9	...	9	
	Ellison's Orange ...	...	...	...	...	6	...	6	
	Chelmsford Wonder ...	...	...	...	...	6	...	6	
	Lord Grosvenor ...	...	...	...	...	7	...	7	
	Christmas Pearmain ...	...	...	...	...	10	...	10	
	Baldwin ...	...	5	...	...	...	...	5	

Species of fruit trees.	Variety.	Planted 1914-18.						Planted 1919.	Total number.	Description.
		Upper garden.								
		Top block.	South block.	East block.	North block.	East extension.	Lower garden.			
1	2	3	4	5	6	7	8	9	10	
Apple trees	Duches of Oldenburg	...	...	6	...	...	...	6	Standards.	
	Norfolk Bearer	...	...	5	1	...	...	6		
	King of Tompkins County.	...	...	6	...	...	...	6		
	Emperor Alexander	...	...	...	6	...	...	6		
	James Grieve	...	...	3	18	...	...	21		
	Cox's Pomona	...	...	2	4	...	...	6		
	Small's Admirable	...	...	6	...	...	...	6		
	New Hawthorden	...	...	5	...	...	...	5		
	Calville St. Saumur	...	7	...	...	...	...	7		
	Reinette de Cazy	...	8	...	...	...	...	8		
	Precoce David	...	3	...	...	...	...	3		
	Kashmir Amroo	...	3	...	...	...	...	3		
	Fenoillet Gris	...	4	...	...	...	4	8		
	Api Petit	...	1	4	1	...	2	8		
	Delicious (Starks)	...	50	12	...	...	...	62		
	King David	...	26	13	...	...	...	39		
	York Imperial	...	...	6	...	...	...	6		
	Paragon Winesap (Starks).	...	...	5	...	...	...	5		
	Jonathan (Starks)	...	3	6	...	...	...	9		
	Black Ben (,,)	...	20	5	...	...	...	25		
	Stayman Winesap (Starks).	...	...	7	...	...	...	7		
	Senator (Starks)	...	1	4	...	...	...	5		
	Grimes Golden (Starks)	...	12	5	...	...	...	17		
	Summer Champion (Starks).	...	2	...	...	...	...	2		
	Mother (Starks)	...	...	6	...	...	...	6		
	Emmett Early	...	...	10	...	...	...	10		
	Baumann's Reinette...	...	...	10	...	...	...	10		
	Grenadier	...	...	6	...	...	...	6		
	Cox's Orange Pippin	...	...	15	...	...	...	15		

Special of fruit trees.	Variety.	Planted 1914-18.					Planted 1912.	Total number.	Description.	
		Upper garden.								
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	
Apple trees	Blenheim Orange	...	...	3	8	...	...	...	11	Standards.
	Calville Blanc	...	...	...	6	...	...	...	6	
	Norfolk Beauty	...	...	15	14	1	...	1	31	
	Reinette du Canada...	...	...	6	4	...	...	...	10	
	Winter Greening	...	...	8	...	...	...	...	8	
	Rev. W. Wilks	...	...	1	...	...	29	7	37	
	Lord Burghley	...	...	6	...	...	...	...	6	
	Lady Henniker	...	...	4	6	...	...	...	10	
	Golden Spire	...	...	4	4	...	...	...	8	
	Bismarck	...	...	4	6	...	...	...	10	
	Calville Rouge d'hiver	...	...	6	...	...	1	...	7	
	Charles Ross	...	...	3	2	...	4	...	9	
	Lord Derby	...	...	...	...	...	...	8	8	
	Barnack Beauty	...	...	...	...	...	6	4	10	
	Horrings Pippin	...	...	3	...	...	16	...	19	
	Rival	...	...	2	...	...	6	...	8	
	Star of Devon	...	...	...	...	...	4	...	4	
	William Crump	...	...	...	...	...	5	...	5	
	Upton Pyne	...	...	...	...	...	15	...	15	
	Early Melon (Starks)...	...	...	...	4	...	...	...	...	
	Wealthy ( " )...	...	...	...	4	...	...	...	4	
	Wilson's Red June (Starks).	...	...	...	6	...	...	...	6	
	Liveland Raspberry (Starks).	...	...	...	6	...	...	...	6	
	Worcester Pearmain...	...	...	...	...	...	...	4	4	
Total		...	1	230	274	47	124	65	731	
	Blenheim Orange	...	...	...	1	11	...	...	12	Horizontal trained.
	James Grieve	...	...	...	...	...	...	4	4	
	Feltham Beauty	...	...	...	2	3	...	...	5	
	Lady Sudeley	...	3	...	...	...	...	3	5	
	Herring's Pippin	...	...	...	2	1	...	3	5	

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	East extension.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Apple trees	Gascogne's Scarlet ...	3	...	...	...	...	...	3	Horizontal trained.
	Charles Ross ...	3	...	...	...	...	...	3	
	Brownlee's Russet ...	3	...	...	...	...	2	5	
	Baumann's Reinette...	3	...	...	...	...	...	3	
	Beauty of Bath ...	...	...	...	...	...	5	5	
	Sturmer Pippin ...	6	...	...	...	...	...	6	
	Cox's Orange Pippin...	...	...	...	2	...	1	1	
	Cox's Pomona ...	1	...	...	...	...	3	4	
	King of the Pippins ...	...	...	3	...	...	2	5	
	Kerry Pippin ...	...	...	...	...	...	1	1	
	Claygate Pearmain ...	...	...	...	...	...	1	1	
	King of Tompkins County.	...	...	3	...	...	...	3	
	Sterling Castle ...	...	...	...	...	...	3	3	
	Total ...	21	...	11	15	...	27	74	
	Sturmer Pippin ...	...	...	...	3	...	...	3	Upright trained.
	Mannington Pearmain ...	...	...	...	3	...	...	3	
	Scarlet Golden Pippin ...	...	...	...	...	...	2	2	
	Washington ...	2	...	2	2	...	...	6	
	Allington Pippin ...	...	...	...	...	...	2	2	
	Golden Spire ...	...	...	1	...	...	...	1	
	Beauty of Bath ...	...	...	...	...	...	2	2	
	Adams Pearmain ...	2	...	...	1	...	...	3	
	James Grieve ...	...	...	...	...	...	2	2	
	King of the Pippins...	...	...	2	1	...	...	3	
	Barnack Beauty ...	...	...	...	...	...	2	2	
	King of Tompkins County.	...	...	...	5	...	...	5	
	Total ...	4	...	5	15	...	10	34	

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913. Lower garden.	T total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	East extension.			
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Charles Ross	...	...	6	...	...	...	6	Palmette Verrier trained.
	Rival	...	...	5	...	...	...	5	
	James Grieve	...	...	6	...	...	...	6	
	Blenheim Orange	...	...	6	...	...	...	6	
	Total	...	...	23	...	...	...	23	
	Baumann's Reinette...	...	4	...	...	...	...	4	Fan trained.
	Golden Spire	...	1	...	...	...	...	1	
	Total	...	5	...	...	...	...	5	
	Rival	...	...	3	...	...	...	3	Double Cordon.
	Total	...	...	3	...	...	...	3	
	Rival	...	...	3	...	...	...	3	Single Cordon.
	Total	...	...	3	...	...	...	3	



Species of fruit trees.	Variety.	Planted 1914-18.				Planted 1918.	Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	Lower garden.			
1	2	3	4	5	6	7	8	9
Pear trees.	Fertility ...	...	53	1	...	18	72	
	St. Swithins ...	...	...	...	...	19	10	
	Beurre Hardy ...	...	17	1	2	...	20	
	Réd October ...	...	...	...	...	9	9	
	Beurre d'Anjou ...	...	6	...	...	...	6	
	Parrot ...	...	...	...	...	10	10	
	William's Bon (Chretien.	...	13	...	...	...	13	
	Seedling Bergamot ...	...	...	...	...	6	6	
	Fondante Thirriot ...	...	10	...	...	10	20	
	Dr. Hogg ...	...	...	...	...	7	7	
	Triomphe de Vienne...	...	6	...	...	...	6	
	Beacon ...	...	...	...	...	6	10	
	Beurre de Narghan ...	...	...	...	...	6	6	
	Charles Ernest ...	...	12	...	...	...	12	
	Roosevelt ...	...	...	...	...	6	6	
	Doyenne d'Ete ...	...	10	...	...	...	10	
	Blicking ...	...	...	...	...	6	6	Bush and pyramidal.
	Gansels Bergamot ...	...	6	...	...	...	6	
	Santa Claus ...	...	...	...	...	6	6	
	Josephine de Malines...	...	6	...	...	9	16	
	Precoce de Juillet ...	...	...	...	...	5	5	
	Dr. Jules Guyot ...	...	11	...	...	6	17	
	Madame Treyve ...	...	...	...	...	10	10	
	Durondeau ...	...	7	1	...	2	10	
	Hassle ...	...	5	...	1	13	19	
	Beurre d'Amaulie ...	...	12	...	...	10	22	
	Emile d'Heyet ...	...	5	...	...	10	15	
	Marie Benoist ...	...	6	...	...	...	6	
	Clapp's Favorite ...	...	5	...	...	10	15	
	Louise Bonne of Jersey ...	...	2	...	...	...	2	
	President Barabé ...	...	5	...	...	...	5	
	Thompson ...	...	5	...	...	...	5	
	Winter Nellie ...	...	4	...	...	...	4	
	Marguerite Marillat ...	...	6	...	...	...	6	
	Seckle ...	...	...	6	...	...	6	
	Beurre Fouquetay ...	...	...	6	...	...	6	

Species of tree.	Variety.	Planted 1914-18.				Planted 1913.	Total number.	Description.
		Upper garden.						
		Top block.	West block.	South block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9
	Directeur Hardy ...	...	...	5	...	...	5	Bush and Pyramid.
	Colmar d'Ete ...	...	6	6	...	...	13	
	Princess ...	...	6	6	...	...	13	
	Belle Julie ...	...	6	6	...	...	12	
	Doyenne du Comice ...	...	3	4	...	...	6	
	Total ...	...	232	60	5	175	466	
	Beurre Hardy ...	...	14	...	...	5	19	Single Cordon.
	Clapp's Favourite ...	...	10	...	...	...	10	
	Durondeau ...	...	8	...	...	...	8	
	Madame Treve ...	...	10	5	...	...	15	
	William's Bon Chretien ...	...	9	...	...	5	14	
	Marquerite Marillat ...	...	12	...	...	5	17	
	Doyenne du Comice ...	...	10	...	...	5	15	
	Fondante Thirriot ...	...	...	5	...	...	5	
	Louise Bonne of Jersey ...	...	10	...	...	8	13	
	Conference ...	...	9	...	...	5	14	
	Emile d'Heyst ...	...	9	...	...	...	9	
	Winter Nelis ...	...	5	...	...	...	5	
	Fondante d'Automne ...	...	...	5	...	...	5	
	Beurre Superfin ...	...	...	...	...	5	5	
	Princess ...	...	...	5	...	5	1	
	Beurre Fochuery ...	...	...	5	...	...	5	
	Beurre Diel ...	...	...	...	...	5	5	
	Directeur Hardy ...	...	...	5	...	...	5	
	Beurre d'Anjou ...	...	...	...	...	5	5	
	Colmar d'Ete ...	...	...	5	...	...	5	
	Total ...	...	106	35	...	48	189	
	Directeur Hardy ...	...	11	...	...	...	11	Horizontal trained.
	Duchess d'Angoulême ...	...	1	...	...	...	1	
	Clapp's Favourite ...	...	2	...	...	...	2	
	Josephine de Malines... ..	...	...	...	...	...	1	
	Emile d'Heyst ...	...	2	...	...	...	2	
	Louise Bonne of Jersey ...	...	1	...	...	...	1	

Species of fruit trees.	Variety.	Planted 1914-18.				Planted 1913.	Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Bourre Superfin ...	...	1	...	...	...	1	Horizontal trained.
	Princess ...	...	6	...	...	...	6	
	Conference ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	2	...	...	...	2	
	Durondeau ...	...	1	...	...	...	1	
	Pitmaston Duchess ...	...	1	...	...	...	1	
	Fondante d'Automne...	...	1	...	...	...	1	
	Doyenne du Comice ...	...	2	...	...	...	2	
	Winter Nelis ...	4	...	...	...	...	4	
	Marquerite Marillat ...	...	5	...	...	...	5	
	Total ...	4	39	...	...	...	43	Standard.
	Kashmir ...	...	...	...	38	...	38	
	Marquerite Marillat ...	...	...	6	...	...	6	
	King Karl (Starks) ...	...	1	...	3	1	5	
	Anjou ( " ) ...	...	3	...	4	...	7	
	Lincoln ( " ) ...	...	3	...	5	...	8	
	Howell ( " ) ...	...	6	...	3	...	9	
	Duchess ( " ) ...	...	3	...	1	1	5	
	Bartlett ( " ) ...	...	8	...	4	1	13	
	Seckle ( " ) ...	...	4	...	...	1	5	
	Marie Louise ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	5	11	...	...	16	
	Conference ...	...	2	...	...	...	2	
	Emile d'Heyst ...	...	1	...	...	...	3	
	Madame Treve ...	...	3	...	...	...	6	
	Count de Lamy ...	...	3	...	...	...	3	
	Louise Bonne of Jersey ...	...	2	...	...	...	2	
	Beurre Capiaumont ...	...	6	...	...	...	6	
	Princess ...	...	2	...	...	...	2	
	Doyenne du Comice ...	...	2	...	...	...	2	
	William's Ben Chretien ...	...	2	...	...	...	2	
	Souvenir du Congress...	...	2	...	...	...	2	
	Marie-Louise d'Uccle...	...	2	...	...	...	2	
	Fertility ...	...	28	5	3	...	36	

Species of fruit trees.	Variety.	Planted 1914-18.				Planted 1913.	Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Seckle ... ..	...	...	2	...	...	2	Standards.
	Bartlett Hybrid (Starks)	...	...	...	5	...	5	
	Beihl Best ( " )	...	...	...	4	2	6	
	Boussock ( " )	...	...	...	3	2	5	
	Triumph ( " )	...	...	...	4	...	4	
	Winter Bartlett ( " )	...	...	...	...	4	4	
	Total ... ..	...	97	24	77	13	210	
	Princess ... ..	...	5	...	...	...	5	Upright trained.
	Conference ... ..	...	...	...	...	3	3	
	Madame Treyve ... ..	...	...	5	...	...	5	
	Marie Louise d' Uccle	...	...	...	...	4	4	
Louise Bonne of Jersey	...	...	...	...	4	4		
Beurre Hardy ... ..	5	...	...	...	...	5		
Fondante d' Automne	...	...	...	...	3	3		
Winter Nelis ... ..	...	...	...	4	...	4		
Conseiller de la Cour...	...	...	...	...	3	3		
Doyenne du Comice...	...	...	...	...	3	3		
Marguerite Marillat...	4	2	...	...	...	6		
Total ... ..	9	7	5	4	20	45		

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1918.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Late Transparent ...	...	...	...	...	0	...	6	Bush.
	Guthrees Late Gage ...	...	4	...	...	...	...	4	
	Deniston's Superb Gage.	...	3	...	...	...	10	13	
	White Botan ...	...	1	...	...	...	...	1	
	Satsuma ...	...	2	...	...	1	...	3	
	Burbank ...	...	3	...	...	...	...	2	
	Prosperity...	...	5	...	...	...	...	5	
	Reine Claudede Bavay	...	3	...	...	...	...	3	
	Belle de Louvain ...	...	...	...	...	...	6	6	
	Curlew ...	...	5	...	...	...	...	5	
	Utility ...	...	2	...	...	...	...	2	
	Greengage...	...	1	...	...	5	...	6	
	Coxs Emperor	...	4	...	...	...	...	4	
	Heron ...	...	5	...	...	...	...	5	
	Mitchelsons	...	8	...	...	...	...	8	
	Monarch ...	...	...	2	...	...	...	3	
	ICKworth ...	...	3	...	...	...	...	3	
	Stark's Gold	...	3	...	...	...	...	3	
	Diamond ...	...	3	...	...	...	...	3	
	Belgian Purple	...	1	...	...	...	10	11	
	Bittern ...	...	6	...	...	...	...	6	
	Rutland Plumcot	...	1	...	...	...	...	1	
	Primate, ...	...	5	...	...	...	...	5	
	Pond's Seedling	...	7	...	...	3	...	10	
	Admiral ...	...	5	...	...	...	...	5	
	Stark's Shiro	...	1	...	...	...	...	1	
	President...	...	6	...	...	...	...	6	
	Stark's Omaha	...	...	1	...	1	...	2	
	Jefferson ...	...	2	...	...	...	...	2	
	Autumn Beauty	...	...	1	...	...	...	1	
	Wyedale ...	...	3	...	...	...	...	3	
	King of the Damsons...	...	...	...	...	2	...	2	
	Kirks Blue	...	3	...	...	...	...	3	

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Fruit trees	Shepherd's Bullace ...	...	...	...	...	3	...	3	Bush.
	Czar ...	...	6	...	...	...	...	6	
	Langley's Bullace ...	...	...	...	...	3	...	3	
	Victoria ...	...	6	...	...	...	...	6	
	White Damson ...	...	...	...	...	3	...	3	
	Prince Englebert ...	...	3	...	...	...	...	3	
	Prune Shropshire ...	...	...	...	...	3	...	3	
	Kashmir Greengage ...	...	4	...	...	...	...	4	
	Merryweather Damson ...	...	...	...	...	10	...	10	
	Count d'Altham gage...	...	1	...	...	...	...	1	
	Stark's America ...	...	...	2	...	...	...	2	
	Stint ...	...	1	...	...	...	...	1	
	Burbanks Giant Prune ...	...	8	...	...	...	4	12	
	Yellow Pershore ...	...	...	...	...	1	...	1	
	Total ...	5	117	7	...	41	30	209	
	Decaise ...	...	...	...	...	1	...	1	Fan trained.
	Kirke ...	...	...	...	...	2	...	2	
	Jefferson ...	...	...	...	...	2	...	2	
	Mallard ...	...	...	...	...	1	...	1	
	Golden Esperen ...	...	...	...	...	1	...	1	
	Oullin's Golden Gage...	...	...	...	...	2	...	2	
	Reine Claude d' Altham.	...	...	...	...	1	...	1	
	Early Transparent ...	...	...	...	...	1	...	1	
	Cox's Golden Drop ...	...	...	...	...	1	...	1	
	Transparent Gage ...	...	...	...	...	1	...	1	
	Greengage ...	...	...	...	...	2	...	2	
	Golden Transparent Gage.	...	...	...	...	1	...	1	
	Belgian Purple ...	...	...	...	...	1	...	1	
	Total ...	...	...	...	...	17	...	17	

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913.	Total number.	Description.	
		Upper garden.								
		Top block.	South block.	East block.	North block.	Lower garden.				
1	2	3	4	5	6	7	8	9	10	
Cherry trees ...	Morello ...	...	16	...	3	3	...	22	Trees.	
	Kentish ...	...	12	...	...	...	16	28		
	Bigarreau Kentish ...	...	...	...	...	...	6	6		
	Gloire de France ...	...	1	...	...	...	5	6		
	White Heart ...	...	...	...	...	...	4	4		
	Black Heart ...	...	...	...	...	...	5	5		
	Kashmir ...	...	24	...	...	...	7	31		
	Montmorency King ...	...	2	...	...	1	...	3		
	Burbank ...	...	4	...	...	1	...	5		
	Total ...	...	59	...	3	5	43	110		
Orange trees ...	Turkey Black Heart ...	...	...	...	...	1	...	1	Fau trained.	
	Late Black Bigarreau...	...	...	...	...	1	...	1		
	Frogmore Bigarreau...	...	...	...	...	1	...	1		
	Noir de Guben ...	...	...	...	...	1	...	1		
	Belle de St. Trons ...	...	...	...	...	1	...	1		
	Early Rivers ...	...	...	...	...	1	...	1		
	Total ...	...	...	...	...	6	...	6		
	Japanese Satsuma ...	...	1	...	...	1	...	2		Trees.
	Japanese Kumquat ...	...	8	...	...	4	...	13		
	Malta Blood ...	...	14	...	...	...	2	16		
St. Michael's ...	...	13	...	...	1	...	14			
Jaffa ...	...	2	...	...	1	...	3			
Malta Oval ...	...	2	...	...	1	...	3			
Silver ...	...	3	...	...	...	1	4			
Excelsior ...	...	1	...	...	1	...	2			
St. Michael's Tanagerin.	...	1	...	...	...	5	6			
St. Michael's Dom Louise.	...	1	...	...	2	...	3			
St. Michael's Sustain...	...	1	...	...	...	1	2			
Ditto Achilles	...	...	...	...	...	1	1			
Total	...	...	47	...	...	11	10	68		

Species of fruit trees.	Variety.	Planted 1914 18.					Planted 1913.	Total number.	Description.		
		Upper garden.									
		Top block.	South block.	East block.	North block.	Lower garden.					
1	2	3	4	5	6	7	8	9	10		
Lime and Lemon trees.	Kaia Lime	...	...	1	2	...	...	...	3	}	
	Imperial Lemon	...	...	...	...	...	...	2	2		
	Gora Lime	...	...	2	1	...	...	...	3		
	Bijou Lemon	...	...	...	...	...	4	...	4		
	Kagui Lime	...	...	6	...	...	...	...	6		
	Total	...	...	9	3	...	4	2	18		
Walnut trees ...	Dwarf Prolific	...	...	7	...	...	...	10	17	}	
	Kashmir ...	...	...	8	2	...	...	...	8		
	Total	...	...	13	2	...	...	10	25		Trees.
Peach trees ...	Princess of Wales	...	...	...	...	3	...	...	3	}	
	Peregrine ...	...	...	...	...	...	3	11	14		
	Alexander ...	...	...	...	...	...	3	10	13		
	Duke of York	...	...	...	...	...	1	16	17		
	Exquisite ...	...	...	...	...	...	...	2	2		
	Late Devonian	...	...	...	...	...	2	...	2		
	Lady Palmerston	...	...	...	...	...	2	...	2		
	Kestrel ...	...	...	...	...	...	6	...	6		
	Hales Early	...	...	...	...	...	3	...	3		
	Total	...	...	...	...	3	20	39	62		
Apricot trees ...	Superb (Starks)	...	...	...	...	...	1	...	1	}	
	Rlenheim ...	...	...	...	...	...	6	...	6		Trees.
	Kashmir ...	...	...	7	...	...	...	...	7		
	Total	...	...	7	...	...	7	...	14		



Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1912.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Fig trees ...	White Marseilles ...	...	...	...	...	...	1	1	}
	Bonjassotte Grise ...	...	...	...	...	...	2	2	
	Monaco Bianco ...	...	...	...	...	...	1	1	
	Total ...	...	...	...	...	...	4	4	
Quince trees ...	Meeks Prolific ...	...	...	1	...	...	1	...	}
	Champion... ..	...	...	1	...	...	...	1	
	Portugal ...	...	...	1	...	...	1	...	
	Total ...	...	...	3	...	...	2	...	
Almond trees ...	Hill Almond ...	...	...	12	...	...	...	...	}
	Total ...	...	...	12	...	...	...	...	

Species of fruit & eos.	Variety.	Planted 1914-18.				Planted 1913.	Total number.	Description.
		Upper garden.						
		South block.	East block.	North block.	Lower garden.			
1	2	3	4	5	6	7	8	9
Wineberry ...	.....	...	...	...	6	...	6	Berries.
Lowberry ...	.....	...	...	...	...	6	6	
King's Ace Berry ...	.....	...	...	...	5	...	5	
Loganberry ...	.....	...	...	...	3	1	4	
Phenomenal ...	.....	...	...	...	3	1	4	
Laxtonberry ...	.....	...	...	...	3	...	3	
Blackberry...	Blowers ...	...	...	...	100	...	100	}
Ditto ...	Pyne's Giant Himalaya Berry of California.	...	...	...	100	...	100	
	Total	...	...	...	220	8	228	
Strawberry	Givon's late Prolific...	...	...	...	900	...	900	Plants.
	Louis Gauthier ...	...	500	...	350	...	850	
	Royal Sovereign ...	3,000	3,000	...	1,250	...	7,250	
	Laxton's Cropper ...	...	...	...	400	...	400	
	Total	3,000	3,500	...	2,900	...	9,400	
Currant ...	Boskoop Giant Black...	...	2	...	...	...	2	Bushes.
	Defender Black ...	...	1	...	...	...	1	
	Southwell's Black ...	...	20	...	20	...	40	
	Total	...	23	...	24	...	47	
Nut trees	White Filbert	...	...	...	3	...	3	Trees.
	Red Filbert	...	...	...	3	...	3	
	Prize Cob ...	...	...	...	3	...	3	
	Kentish Cob	...	...	...	3	...	3	
	Total	...	...	...	11	...	11	

Species of fruit trees.	Variety.	Planted 1914-18.				Planted 1913.	Total number.	Description.
		Upper garden.						
		South block.	East block.	North block.	Lower garden.	Lower garden.		
1.	2	3	4	5	6	7	8	9

Grape Vines	{	Campbell's Early (Starks).	...	2	...	...	2	} Vines.
		Hicks (Starks)	...	3	...	...	3	
		King ( " )	...	2	...	...	2	
		Eclipse ( " )	...	2	...	...	2	
		King Philip( " )	...	2	...	...	2	
		Wilder ( " )	...	2	...	...	2	
		Worden ( " )	...	2	...	...	2	
		Niagara ( " )	...	2	...	...	2	
Total		...	17	...	...	17		

*Summary of Fruit Trees planted to 30th June 1918.*

	1913.	1914-18.	Total.
1	2	3	4
Bush Apple trees ... ..	432	1,949	2,381
Standard „ „ ... ..	55	676	731
Horizontal trained Apple trees	27	47	74
Upright „ „ „	10	24	34
Palmette Verrier „ „ „	...	23	23
Fan „ „ „	...	5	5
Double Cordon „ „ „	...	3	3
Single „ „ „ „	...	3	3
Bush and Pyramid Pear „	175	281	456
Single Cordon „ „	48	141	189
Horizontal trained „ „	...	43	43
Standard „ „	12	198	210
Upright trained „ „	20	25	45
Bush Plum trees ... ..	30	170	200
Fan trained Plum trees	...	17	17
Cherry standard trees	43	67	110
Cherry fan trained trees	...	6	6
Orange trees ... ..	10	58	68
Lemon „ ... ..	2	16	18
Walnut „ ... ..	10	15	25
Peach „ ... ..	39	23	62
Apricot „ ... ..	...	14	14
Fig „ ... ..	4	...	4
Wineberry ... ..	...	6	6
Lowberry ... ..	6	...	6
Loganberry ... ..	1	3	4

	1918.	1914-18.	Total.
1	2	3	4
King's Acre Berry ... ..	...	5	5
Phenomenal „ ... ..	1	3	4
Laxtonberry „ ... ..	...	3	3
Giant Himalaya Blackberry ... ..	...	100	100
Blower's Blackberry ... ..	...	100	100
Strawberry plants ... ..	...	9,400	9,400
Currant Bushes ... ..	...	47	47
Almond trees ... ..	...	12	12
Nut „ ... ..	...	11	11
Quince „ ... ..	...	5	5
Grape Vines ... ..	...	17	17

C. H. HOLDER,

*In charge, Fruit Experiment  
Station, Shillong.*

*The 24th August 1918.*

*Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st July 1917 to 30th June 1918.*

Receipts.	Amount.	Expenditure.	Amount.
1	2	3	4
	Rs. a. p.		Rs. a. p.
Sale-proceeds of Apples ...	638 10 0	Allowance to Superintendent	3,000 0 0
„ of Pears ...	17 0 0	Establishment ...	2,297 2 8
„ of Peaches...	19 0 0	Petty construction ...	1,333 2 0
„ of Strawber- ries.	23 12 0	Seeds, Plants and Manures	1,414 7 0
„ of Strawberry plants.	126 6 0	Instruments, Appliances, Apparatus and Machinery.	134 1 0
„ of Timber ...	87 6 0	Wages of labourers ...	4,138 12 0
		Service postage ...	20 0 0
		Other charges ...	580 0 4
Total Receipts ...	909 2 0	Total Expenditure ...	12,917 9

ANNUAL REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 30TH JUNE 1918.

This station was established in January, 1914. It is situated on the Sylhet Road,  $3\frac{1}{2}$  miles to the west of the subdivisional station of Karimganj, which lies on the Assam-Bengal Railway.

General.

The total area of the farm is a little under 80 acres. Leaving out a compact block of 8 acres which has been set apart for the farmstead and quarters for the staff, and the area covered by roads and drains estimated at 4 acres, the net area available for cultivation is about 68 acres.

The station is devoted mainly to experimental work on rice and jute.

2. The farm lies close to the Langai river which occasionally rises in high flood, and lays the country all round under water. This liability to floods is characteristic of the rice lands in the locality.

Character of land and soil.

The soil of the greater portion of the farm is a deep alluvial clay of fine texture, though not particularly heavy. In the higher lands, it is somewhat lighter in character and may be described as a medium loam.

3. Some improvements were made in the apprentices' quarters and cattle sheds, and ideal wire fencing was purchased for enclosing the staff quarters, but beyond this no important changes were made in equipment during the year.

Equipment.

During the year 1915-1916 a long drain, leading from the southeast corner of the farm to a *khal* near by, was dug for the purpose of draining the residential area; in former years this area was liable to be converted into a swamp during the rainy season.

It was subsequently found that when the water rose in the Langai river during high flood, there was a back-flow up the abovementioned *khal* and along this drain. It was, therefore, decided to erect a small sluice gate with the object of preventing such back-flow of river water into the farm lands.

The work was carried out in the cold weather of 1916-1917 at a cost of slightly under Rs. 100 and has proved beneficial

Last cold season the earth obtained in clearing a drain which runs along the eastern boundary of the farm was thrown up in the form of a protecting bank. Although this bank is little more than eighteen inches above the level of the surrounding land, the effect in keeping out flood water has already been quite noticeable. It seems that this bank could be advantageously enlarged and extended on the northern as well as the eastern side, to secure the farm against any but the highest floods. If this could be achieved the expenditure of 200 or 300 Rupees which would be necessary would be thoroughly justified. Even in high flood such a bank would be of much value because if the flood water could be kept out even for a few days, the risk of injury to the farm crop would be much reduced.

The total number of working cattle remains at 30 as at the close of the previous year, and these cattle have remained in healthy condition throughout. Towards the end of the present year a new departure was inaugurated by the provision at the farm, of a stud bull for the use of the surrounding district. As the animal was brought from the Upper Shillong Farm only a few weeks before the end of the year, no opinion can yet be formed as to whether or not he will prove useful in the neighbourhood.

4. The official agricultural year is found extremely inconvenient for the purpose of report. It covers the latter half of one *kharij* season and first half of the *kharij* season following, and includes, of course, the *rabi* season intervening.

The following table shows the rainfall during each of these periods:—

—				Actual.	Normal.
1				2	3
Last half of <i>kharij</i> 1917.					
July	1917	...	...	24.95	23.11
August	"	...	...	27.72	22.83
September	"	...	...	13.81	18.58
October	"	...	...	6.7	8.31
Total				73.18	72.83



—				Actual.	Normal.
1				2	3
<i>Rabi</i> 1917-18.					
November 1917	...	...	...	4.78	1.31
December 1917	...	...	...	...	0.56
January 1918	...	...	...	.08	0.75
February 1918	...	...	...	.44	1.46
Total				5.30	4.08
First half of <i>kharif</i> 1918.					
March 1918	...	...	...	14.46	8.80
April 1918	...	...	...	9.72	18.72
May 1918	...	...	...	18.69	21.19
June 1918	...	...	...	25.54	31.45
Total				68.41	80.16
Total for the year				146.89	157.07

The *kharif* season of 1917 was a satisfactory one and no floods occurred. There was some shortage of rainfall in September at the time of transplanting late paddy, which somewhat reduced the yield from that portion of the crop, but otherwise the season was very favourable and good crops were obtained. The *rabi* season was not a favourable one, as, except for a unseasonably heavy downpour on the last day of October, no rain of any consequence fell during the four cold-weather months. The combined effect of this heavy downfall at the very beginning and of the subsequent absence of rainfall, was that *rabi* crops were generally poor.

5. As befits a station situated in such an extensive rice-growing district as the Surma Valley, attention is devoted mainly to effecting improvements in this staple.

Rice breeding. Rice-breeding experiments were arranged in 1914, after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Rai Bahadur B. C. Basu, Special Officer for Agriculture, and Mr. G. P. Hector, Economic Botanist, Bengal. These experiments have been carried on since.

It was hoped to obtain definite results after 3 or 4 years' work, but, owing to the unfortunate floods which have interfered with the continuity of the experiments, the work has been delayed, and a further period of a year or two will be required before definite results can be expected.

Ordinary rice seed is usually found on examination to be a mixture of different types of unequal quality and productive power. Some of these types are pure, and, therefore, breed true; others are the products of natural crossing and split into types differing in character, and are consequently unreliable. The types also differ in regard to their productive power and other characters.

The method of breeding followed in the farm starts by growing in the first season, from ordinary village seeds, as many local varieties of rice of each class as can be procured, and in picking out from each as many distinct types as can be detected while the crop is still standing in the field, each type being represented by the ripe ears taken from a single plant.

The next step is to grow the various lots of seed thus obtained in small plots side by side, first with the object of testing which of these types are constant and therefore pure, and which again split as the result of previous crossing, and secondly, with the object of comparing the pure types in regard to yielding power and other characters. Though the rice flower is normally self-fertilized, a certain amount of natural crossing is known to occur. A clear space of 3 to 6 feet around each plot is kept in order to minimise the risk of inter-crossing between adjacent types.

The next and third step is to take the pure types and grow them a second or even a third time (which is to be the work of the third or fourth season) in order to confirm the results of the second season as to their respective merits.

In this way at the end of the third or the fourth season, we should be able to fix upon one or more of these pure lines, as being more prolific and of better quality all round, than the rest within their own class. The next and last step will be to propagate these selected pure lines on a field scale, for the purpose of distributing the produce as seed.

The experiment was commenced in 1913-1914 with four classes of rice, namely, (1) early *Aus* rice, which is usually grown broadcast and of which two crops may be taken in the course of a year (2) transplanted *Aus*, (3) *Sail* or winter rice, (4) *Asra*, which comprises the comparatively short stemmed varieties of *Amon* or swap winter rice, and which is capable of being grown either broadcast or transplanted.

The floods of 1915 destroyed all work done up to that time with transplanted *Aus*, *Sail* and *Asra*, and the selection work with regard to these classes had to be undertaken *de novo*. It was then decided to restrict the work for some years to come to (1) early *Aus* which was spared by the 1915 floods and (2) *Sail* transplanted winter rice, which forms the most important class of rice grown in the country.

Below is noted the work done on these two classes of rice since the experiment started.

*Early Aus*.—This class comprises three sub-classes of rice *viz.*, *Murali*, *Chengri* and *Dumai*. These differ from each other in regard to the depth of water which they can stand during the later stages of growth and the time they take from sowing to harvest. A total of 161 distinct types was obtained by the selection work done in 1914. Out of these, 61 were obtained early enough to permit of their being sown again in September of that year.

The resulting plants were examined as to purity, and 3 types were rejected as unsuitable for further work. Early in 1915 these types were sown again, but were destroyed by the July flood of that year. Fortunately, however, duplicate halves of the seed of 57 of these types had been kept in reserve, as a precaution against the accidental loss of the stock, and, with these seeds the work was continued in that year. These 57 types of early *Aus* were sown in September, and reaped in December, 1915, and as was to be expected, the yields varied within very wide limits. From the seed thus obtained three further series of plots were sown in May 1916, that year's crop being the third generation from the first selected types. Full records are kept of the dates of sowing, flowering, and harvesting of each type, and of its yield of grain and straw. These particulars, together with a description of the characters of each type, are kept in a register of pure cultures on the farm. As was expected, the variations in yield among the plots of the third generation were considerable, and not sufficiently in agreement with the yields obtained in the first two generations, to enable a selection to be made.

A further set of one series was laid down in September, 1916, with seeds from the early crop of that year. These plots were injured by the October floods to such an extent that comparative results could not be obtained, although sufficient seeds of that, the fourth generation, were harvested, to enable the work to be continued in the following year. One of these types was obviously different from the others, and was in consequence discarded.

The work was continued in the year under report, the selected varieties being again tested and compared in their fourth generation. A few varieties which did well in 1916 also gave a heavy outturn in the past year, but as yet no variety has been found sufficiently outstanding, to justify any recommendations being made. From the fifth generation of 1917 single seedling plants were again selected and the grain from these has been planted for the production, in the coming year, of the sixth generation. Plots of equal size and condition have been selected, and equal number of seedlings transplanted in all the plots, in this way the purity of the strain is maintained, and the respective merits of all the types can be carefully compared.

*Sail*.—This is the most important class of rice in Assam. As the result of the work done in 1915, 580 types were separated, and these had just been sown in seed beds, when the great flood of July came and destroyed them all. For the purpose of making the primary selection of types for a fresh start, seeds of 148 varieties of this class of rice were then collected, mostly from different parts of the Sylhet district, a few being obtained from the Sibsagar district, and some being the produce of the farm itself. On the receipt of these varieties of *sail*, each was described in detail, and all particulars entered in the "register of type selection of *sail* rice" kept in the farm.

The seeds of these 148 varieties were sown in June, and transplanted towards the end of July, 1916. Although the plots were injured by the October floods, sufficient plants remained to enable representative types to be selected from each plot for the following year's work.

Five additional types have been included in 1916 bringing the total up to 153, all of which were grown as pure line cultures in 1917.

Among the 153 types with which we began this work, a number were specially fine rices, which are only grown by cultivation on a very small scale for luxurious tastes or special purposes. As such varieties usually give a very light crop, a few of the very poorest yielding varieties have been discarded. Again, a number of varieties were found to have an objectionable amount of awns or to be otherwise undesirable, and of such kinds a further rejection has been made. Altogether 48 of what seemed decidedly poorer varieties have been rejected, and the work is being continued in the present year with the remaining 105 types. A few other types have since been obtained; so that altogether we have for comparison 109 types in the coming year.

Paddy seeds which may have fallen from the previous year's crop and become mixed in the soil, retain the germinating capacity for a very long time. In order to free the experimental area from any such seeds, it has been found necessary to prepare the land a number of times, and to allow two weeks or so to elapse between one preparation and the next, so as to permit stray seeds to germinate. In this way the land carrying these experimental plots was prepared six times, before it was considered safe to plant the pure types. Even when all precautions are taken, plants of a different type from the original selection are occasionally found at harvest time. Some of these may have been washed in by flood water or carried by implements, or they may be the product of cross fertilization which occurs rarely in the rice plants.

There appears to be a difference of opinion among Botanists, as to the extent to which it may be possible to improve the productivity of a variety, by selecting heavy yielding single plants from that variety.

*Intra-varietal selection experiment.*

In order that some information might be gained on this point, the above experiment was begun in the past year. *Lati sail* as one of the heaviest yielding local varieties was selected for the trial, seedlings were transplanted in 1<sup>10</sup>th of an acre on the 10th July 1917. At harvest time 100 plants having the same characters as the original variety were selected at random, and kept separately. All the well-formed grains of the ears of each single plant were afterwards counted, and the number of grains was found to vary from 232 to 1,140. The seeds of five of the heaviest yielding plants will be tested against five of the least productive, each being grown separately and as a pure line type.

6. The experiments carried out on a small scale included the following :—

*Minor experiment.*

(1) *Bonemeal as manure for double crop rice land versus no manure.*—This experiment which was begun in 1915 was designed to give some information, firstly, as to whether or not bonemeal-manuring will prove profitable on the Karimganj Farm or similar rice lands, and secondly, as to the quantity of bonemeal which should be applied.

Bonemeal has been used at three different rates, viz. :—

(a) At 247 pounds per acre applied in alternate years with no manure in the intervening years.

(b) At 49½ pounds per acre applied in alternate years and no manure in the intervening years.

(c) At 247 pounds per acre applied yearly.

The first crop of 1915 and the second crop of 1916 were injured by floods and no results were available. The yields, as far as they have been obtained for three years, are shown in tabular form :—

	Yield per acre in pounds.			
	1915 2nd crop. £	1916 1st crop.	1917 Two crops.	Average Annual crop.
1	2	3	4	5
Bonemeal 347 pounds per acre in alternate years ... ..	3,336	1,537	4,434	3,119
No manure ... ..	2,788	1,435	4,164	2,795
Bonemeal 494 pounds per acre in alternate years ... ..	2,962	1,576	4,277	2,936
No manure ... ..	3,013	1,536	4,066	2,871
Bonemeal 247 pounds per acre yearly ...	2,902	1,605	3,812	2,773
No manure ... ..	3,065	1,475	3,353	2,631

The disturbing effect of the floods in the first two years makes this experiment of little value. The average yields, however, indicate that a light application will be more profitable than a heavy one.

The question as to whether or not any application of bone-meal is likely to yield a profit on soil, such as that of Karimganj Farm, can only be decided by a continuation of the experiment and accordingly similar work is again being carried out.

(2) *Green manuring for rice crop versus no manure.*—This experiment, started in 1915 with cowpea and *Dhaincha*, was continued in 1916 with slight modifications. Duplicate plots were treated with ground limestone at 823 pounds per acre in that year. The same series of plots was again green cropped in 1917, and the average yields for the three years were as follows :—

	Pounds per acre.
No manure ... ..	1,817
<i>Dhaincha</i> alone ... ..	2,125
Cowpea alone ... ..	1,804
No manure ... ..	1,844
<i>Dhaincha</i> and 823 pounds ground limestone in 1916 ...	2,192
Cowpea and 823 pounds ground limestone in 1916 ...	2,157

Cowpea does not grow well on the farm, and even on the limestone area the crops are poor. *Dhainchi* has always grown successfully, and is specially good on the plots manured with ground limestone.

The *sail* paddy crop was slightly damaged in parts by the October floods of 1916, and, therefore, the above figures are not absolutely comparative. There would, however, seem to be no doubt of the benefit to the succeeding rice crop of a well-grown leguminous crop, as shown by the crop produced on the *Dhainchi* plots. A somewhat similar increase has been obtained from those plots which received ground limestone as an additional dressing in 1916. It would, however, be difficult to estimate how much of the increased yield was due to the green crop, and how much to the limestone. It is only right to say that the cowpea crop has always been a very small one, even on the limestone plots.

(3) *A combined variety and manurial experiment on jute.*—Three varieties were tested against one another, *viz.*, Kakaya Bombai, a pure line selected by Mr. R. S. Finlow, Fibre Expert, Bengal, a local variety, and a variety obtained from the Goalpara district.

The average outturn of fibre in pounds per acre for the three past years was as follows :—

— — —				Kakaya Bombai.	Local Variety.	Goalpara Variety.
1				2	3	4
Yield per acre in 1915	...	...	...	2,036	1,224	1,738
Ditto in 1916	...	...	...	1,734	1,115	1,042
Ditto in 1917	...	...	...	1,441	1,301	915
Average for three years	...	...	...	1,704	1,213	1,231

The yields obtained from Mr. Finlow's variety leave no doubt of the great superiority of this selection over any of the ordinary varieties.

The manurial experiment on this crop was upset by a hail-storm, which occurred in the middle of April and which seriously injured the young jute plants, then 12" to 18" high.

Although late in the season six plots were resown, three had been manured with cowdung at  $5\frac{1}{2}$  tons per acre and three with cowdung at the same rate *plus* 820 pounds ground limestone per acre.

The average yield of fibre given by the cowdung plots was 1,045 pounds per acre, while the cowdung and limestone gave 1,359 pounds, that is an increase of 30 per cent.

Owing to the injury by hail most of the jute crop was of little value for fibre, and as there is a rapidly increasing demand for seed of the Kakaya Bombai variety, the largest number of the plots under this variety was kept for seed. The yield of seed was at the rate of 346 pounds per acre.

(4) *Jowar as fodder in the rains.*—*Jowar* was grown as a rains crop on an area of .75 acre. Part of the crop was fed green, and part was chopped up for silage. The latter was not a great success as the plants had become too ripe before the preparation of silage was commenced.

The yield of green fodder was almost five tons per acre.

(5) *Dacca selected rices against country rices.*—As in previous years Mr. Hector's selected rices, *Indra Sail*, *Lambachikan* and *Kandulia* were tested against a few of the most productive local rices.

The experiment was carried out in two separate series. In the first series 8 varieties were grown in plots of  $\frac{1}{10}$ th acre each, and the same number of seedlings was transplanted in each plot. In the second series it was arranged that six varieties should be tested in duplicate plots of  $\frac{1}{10}$ th acre. *George Sail*, however, was grown in one plot only as there were insufficient seedlings to transplant a second.

The following table shows the average results of these tests in pounds per acre :—

					First series.	Second series.	Average.
1					2	3	4
Lati Sail	...	...	...	...	2,530	2,200	2,365
Terabali	...	...	...	...	3,080	2,536	2,858
Indra Sail	...	...	...	...	2,832	3,180	3,006
Kandulia	...	...	...	...	2,970	2,440	2,705
Lambachikan	...	...	...	...	3,630	2,640	3,135
Balam	...	...	...	...	3,794	...	...
Hati Sail	...	...	...	...	3,300	...	...
George Sail	...	...	...	...	4,042	2,640	3,341



From the average yields here given, it would seem that George Sail is a heavier cropping variety than the Bengal rices, but this can only be decided by further trials, and in the coming year it is proposed to grow all the 8 varieties in duplicate plots of  $\frac{1}{10}$ th acre each.

(6) *Specific gravity selection of paddy seed.*—An experiment to test the method of selecting rice seed by specific gravity was carried out. The paddy seeds were immersed in saturated brine, and only those grains which were found to sink were used for seed.

Selected and ordinary unselected seeds were then grown under similar condition in seed bed, and the seedlings transplanted into similar duplicate plots. The seedlings were transplanted singly at a distance of 9" apart.

The average yields obtained were 1,962 pounds per acre from selected seed, and 1,784 pounds from the unselected seed.

(7) *Ground limestone as manure for paddy land.*—This experiment was arranged in two series. In the first, ground limestone was applied at 820 pounds per acre in the cold weather of 1916, and transplanted *aus* paddy was grown on this area. In the second series the ground limestone was applied to duplicate plots at the above rate, immediately before transplanting in August.

The average yield from the lime plots was 2,161 pounds per acre, against 1,906 pounds from the unmanured plot. This increase of 255 pounds or over 3 maunds per acre is quite a useful one. We are arranging to repeat the experiment on the same area in the present year, to find whether the effect continues for more than one year, and whether the application of limestone is likely to be profitable.

(8) *Improved varieties of sugarcane from the Jorhat Farm.*—The three varieties B 147, B 376 and striped Mauritius were grown on a small scale.

The farm lands are situated at too low a level for the successful growth of sugarcane on a large scale, but a small area is grown with the object of giving the farm apprentices a knowledge of the cultivation of sugarcane, and of the making of *gur*.

7. A large area of non-experimental rice was grown during the year. Together with the experimental rice, it covered almost the entire area of the cultivated portion of the farm, the balance being occupied by small areas, of sugarcane, and of jute and *dhaincha* which were grown for seed.

Non-experimental  
crops.

The total yield from the rice crop including the experimental *sail* rice was as follows:—

	Approximate area.	Total yield.	Yield per acre.
1	2	3	4
	Acres.	Tons.	Pounds.
Rice ( <i>asra</i> ) ... ..	27.1	27.63	2,362
Rice ( <i>sail</i> ) ... ..	26.2	23.3	1,992
Total in 1917 ... ..	53.3	50.93	2,140
Total in 1916 ... ..	53.90	25.26	1,051
Total in 1915 ... ..	52.64	47.93	1,991

*Dhaincha* was kept for seed on an area of 14 acres, and gave an outturn of 206 pounds, or at the rate of 572 pounds per acre.

8. A variety of cold weather crops was tried in the past *rabi* season. The land was well prepared in October, but the heavy rainfall which occurred at the end of that month spoiled all arrangements. The land was afterwards prepared a second time, but the work could not be so thoroughly done, and, therefore, the *rabi* crop did not get a favourable start.

Potatoes gave a small crop of 2.12 tons per acre, *cheena* gave about 200 pounds per acre and the yield from the other crops pulses, oil-seeds and cereals was negligible.

9. No very serious damage was caused to the farm crops, although different insect pests made their appearance at various times.

The Farm Manager continues to take timely steps to combat any pests of the kind. Hand-picking, catching by light traps and by bag net, were variously resorted to, and the result was that no damage of any consequence was suffered by the farm crops during the year.

In the early stages of the development of the hairy caterpillar, the grubs are found clustered together on the leaves of the affected plants. At this stage much damage can be avoided by picking off all leaves bearing clusters of caterpillars, and killing the caterpillars in hot water or a little kerosine oil. This method has been very successfully carried out with the jute crop on the farm during the last few years.

The rice bug (*Leptocoris varicornis*) is the cause of immense damage to the rice crop each year, and particularly to the early varieties. The most effective method of checking the ravages of this insect, is to prepare a light cloth about 15 feet long and 4 feet wide. Two boys used this by standing at opposite ends of the cloth, and with a corner in each hand they allow the middle to fall, and bring up the sides until they are about 18 inches apart. One side of the bag net so formed, is allowed to sweep along the top of the affected crop, while the workers run quickly across and across the plot. At each end the bag net is closed and twisted to destroy the many bugs which are captured in this way.

The stem borer moth is attracted by any light during the night time, and can be easily destroyed on this account. If an ordinary hurricane lamp is suspended over a barrel or tub of water, which has been covered with light film of kerosine oil, the moths will flutter in large number round the lamp and most of them will ultimately fall into the water and be killed by the kerosine. Where no large vessel is available, a small raised pond could be made with mud banks, filled with water and covered with a spoonful of kerosine, and a torch placed over it would provide sufficient attraction.

10. The receipts during the year amounted to Rs. 2,854-10-10 but a sum of Rs. 1,320-9-4 was derived from the sale of seed paddy from the previous year's crop. As the whole crop of paddy has not been sold within the agricultural year only a close estimate of the total receipts can be given. Paddy was sold within the year worth Rs. 1,534-1-6. Paddy to the value of Rs. 66 was used for seed distribution throughout the district, and at the end of the year there remained in stock, paddy, *Kalai*, etc., of an estimated value of Rs. 145, making a total of Rs. 1,745-1-6.

This makes a total annual income for the year of approximately Rs. 1,800 against an income of Rs. 2,337 in the previous year. The great fall in receipts here shown is due to the fact that the crop of paddy had to be sold at about Re. 1-4-0 per maund, as against double that price in the previous year.

The total expenditure was Rs. 7,453-8-10 which compares with Rs. 7,294-2-11 in the previous year. It was distributed as follows :—

				1917-1918.		
				Rs.	a.	p.
Establishment	...	...	...	2,699	1	4
Petty construction, including fencing, roads, bridges, etc.	...	...	...	525	14	0
Purchase of machinery	...	...	...	105	11	0
Feed of cattle	...	...	...	455	10	2
Seeds, plants and manures	...	...	...	143	3	10
Wages of labourers	...	...	...	2,246	14	9
Petty repairs	...	...	...	737	6	3
Books, maps and periodicals	...	...	...	36	8	0
Service postage stamps and telegrams	...	...	...	60	0	0
Unspecified charges	...	...	...	443	3	6
Total	...	...	...	7,453	8	10

#### 11. The sanctioned establishment of the farm consists of :—

##### Staff—

				Rs.
1 Farm Manager	...	...	...	100—5—200
1 Assistant Farm Manager	...	...	...	25—1-8—40
				Plus Rs. 10 Local allowance.
1 Farm clerk	...	...	...	25—1-8—40
1 Peon	...	...	...	8 0 0

In addition, arrangements are made for the entertainment of six apprentices to be trained for eventual employment, as Agricultural Demonstrators. The term of the training extends to 2 years.

The first apprentice trained at the farm was appointed as Demonstrator in August 1915. During the year 1916-17, three young men completed their training and were appointed as Demonstrators. The vacant apprenticeships were immediately filled up, and during the past year two more have finished their training. One has been appointed as Demonstrator and the other has suffered from ill-health since and cannot take up work. During the first half of the year under report six apprentices were entertained. In the latter half of the year one apprenticeship was kept vacant with the object of getting a suitable Muhammadan candidate, a suitable man has since been selected and

is to be appointed from the beginning of the present year. The scheme of giving a preliminary training to young men of the *Bhadralog* class intended for scholarships at Sabour was continued during the year. These young men, who are given an opportunity of qualifying for posts as Agricultural Inspectors, are trained in practical agriculture for one year. Two were selected in the beginning of the year under report. They worked satisfactorily and have since been awarded scholarships at Sabour. It has been decided not to fill the vacant apprenticeships as young men of a sufficiently high standard of education were not forthcoming.

Babu Surendra Nath Gupta, who was confirmed in the appointment of Farm Manager in August 1916, remained in charge throughout the year.

Srijut Nabin Chandra Barua resigned his post of Assistant Farm Manager at the beginning of the year, and was succeeded by Babu Girindra Kumar De who was promoted from the post of Agricultural Demonstrator, Cachar, to that of Assistant Farm Manager. Babu Nirod Bihari Sarma resigned his post of Farm Clerk towards the end of the year. He has been replaced by the appointment of Babu Jatindra Chandra Dutta to the vacant post.

J. W. MCKAY,

*Deputy Director of Agriculture,  
Surma Valley and Hill Districts.*

SHILLONG, }  
The 8th July 1918.)

ANNUAL REPORT OF THE KAMRUP SUGARCANE  
EXPERIMENT STATION FOR THE YEAR ENDING  
THE 30TH JUNE 1918.

1. *Introductory.*—The objects and scope of this experiment were set out in paragraph 1 of the report for 1914.\* For reasons explained therein it was proposed to take up 1,000 acres more or less, reclaim it and grow cane on it. Unforeseen circumstances have delayed the full accomplishment of this scheme up to date. The area reclaimed and under cultivation at the present time is some 18 blocks, comprising 817 acres in all, of which some 503 acres are now under cane plant and ratoon.

The area under cultivation on 30th June 1917 was 650 acres, the remaining 167 acres having been reclaimed during the year under report. Last year's report dealt up to 30th June 1917, with the ratoon and plant cane crops planted respectively in February to March 1916 and in February to March 1917. The present report is concerned with the subsequent development of those crops, which were harvested in March 1918, and also with the operations of this the fourth year of the experiment proper, including the preparation of the land, planting the new crop and its subsequent cultivation and behaviour to the end of June 1918.

2. *Land and communications.*—The site of the experiment is situated in North Kamrup under the Bhutan Hills about 17 miles by road north of Nalbari station, Eastern Bengal Railway, and lies between the new and old Pagladiya rivers and near the village of Topolia. The farm is approached from Nalbari station by a public road northward to Garbhitar village, some 10 miles, where a village track leading to Khagrabarigaon has been widened out and made into a carting road and extended to the present farm site which is 7 miles from Garbhitar. The greater portion of this tract consists of high land carrying tall grass jungle, with occasional swamps which are, however, capable of drainage, the fall from the hills to the south being from 15 to 20 feet per mile.

3. *Rainfall.*—Farm records have been kept since January 1915; the following table shows the figures for the Agricultural

\* Annual report of the Kamrup Experiment Station, year ending June 30th 1914.

year ending June 30th, 1918, with monthly averages of previous years :—

				Inches.	Average of previous years since January 1915.
1				2	3
July	(1917)	...	...	18.57	23.46 (2 years' average).
August	"	...	...	12.87	18.76 "
September	"	...	...	9.96	7.59 "
October	"	...	...	8.61	6.68 "
November	"	...	...	Nil	0.10 "
December	"	...	...	Nil	0.13 "
January	(1918)	...	...	Nil	0.25 (3 years' average).
February	"	...	...	0.25	2.47 "
March	"	...	...	3.56	3.57 "
April	"	...	...	4.80	6.26 "
May	"	...	...	9.25	17.69 "
June	"	...	...	25.23	16.89 "
Total				93.10	105.85

The rainfall during 1917, January to December, totalled 90.5 inches and apart from some shortage in the early months of the year was well distributed, ceasing for all practical purposes about the middle of October.

From January to May 1918, which covers the important periods of planting, germination and early growth, the rainfall was some 12 inches below the average for the previous three years. Though germination and early growth more particularly of the earliest planted cane, was somewhat retarded in consequence, the young crop has since made very good progress and promises well.

4. *Soil*.—The soil of the high land varies from good loam to sandy loam on a sandy sub-soil. In a few places, the sand comes to the surface, but usually there is from 1 to 3 feet of good soil, while in the swamps the soil is stiff, on a stiff sub-soil, although it is probable that sand exists at no great depth. Except on the few sandy patches the soil is dark brown or black in colour, denoting good supplies of organic matter. On the whole, the soil is a good loam, easily worked once reclaimed, and very suitable for cultivation. Moreover, the soil is well adapted to the climate; the annual rainfall being high and well distributed demands a light free draining soil such as exists here.

Judging by the growth of the other crops, as well as sugarcane, the present fertility is high, and except on some of the lower lying parts, which before reclamation and drainage by us have probably been more or less swampy for generations, there is no evidence of any toxic factor; moreover, on these lower lying areas the toxic factor apparently rapidly disappears under cultivation after drainage and heavy rain. The evidence of fertility as shown by the growth of many and diverse crops confirms some soil analyses made personally some 4 years ago on samples from an adjoining tract.

5. *Buildings, fencing, etc.*—The buildings consist of the Manager's bungalow, staff quarters, office with dispensary, coolie lines, cattle shed, godown, smithy, etc. For the extension areas one mile of wire fencing was purchased at a cost of Rs. 1,555-8-0, making a total of  $4\frac{1}{2}$  miles of wire fencing enclosing the whole farm.

As in previous years and in spite of the fencing, bears caused a good deal of damage, though pig, deer, etc., were excluded.

6. *Cattle*.—There are 83 head of cattle on the farm at present, of which 18 belong to Government and 65 to Mr. Maxwell. These were very hard worked during the year, carting out machinery and plant for the factory, etc., etc.

At present the cattle are in good condition.

7. *Water-supply*.—Norton tube wells are used with great success, and an excellent supply of drinking water is available all the year round. These wells, distributed over the cane area, provide water also for the engines. In addition, a permanent running stream close by the coolie lines supplies water for washing purposes, etc.

8. *Labour*.—As in previous years labour was recruited personally by the Manager with the sanction of the Bihar and Orissa Government from Ranchi, the only difference this year being that recruiting was done on a 12 months basis instead of for 6 months.



This system works excellently, and a certain number of coolies have settled down here. Generally speaking, this imported labour force keeps very good health. At the moment the general health is satisfactory.

9. *Cultivating tackle*.—This comprises:—

- 2 steam tractors, Fowler's compound engines;
- 1 five-furrow double ended plough;
- 1 harrow;
- 1 cultivator;
- 1 roller;
- 1 ridger;
- 1 leveller;
- 1 ditcher;
- 1 motor plough, Fowler-Wyllie.

Most of the above has now been in use for 4 seasons and is in sound condition.

Spare parts for the engines to the amount of Rs. 3,609 were purchased during the year.

10. *Drainage scheme*.—The system of drainage adopted in 1916, outlined in paragraph 11 of the report for 1916, having proved so efficient, has been extended to the new area reclaimed, and is working quite satisfactorily. The water table has been considerably lowered in consequence, and the heaviest falls of rain are rapidly carried away, surface accumulations after such falls being now a thing of the past. The reclamation and drainage of new extension areas year by year undoubtedly improve the drainage of those areas previously reclaimed and put under cultivation, by dealing with water which heretofore used to flow in from surrounding unreclaimed land.

11. *Cane harvested—February to March*.—This comprises 250 acres of ratoons of the plant cane crop which was planted up in 1916 and harvested as plant cane in 1917, in addition to 260 acres of plant cane which was planted up in 1917. Reference may be made to paragraphs 11, 12 and 13 of last year's report. The early growth of these crops up to the end of June 1917 was therein described. It remains to outline its subsequent progress. The amount and distribution of the rainfall was favourable for the remainder of the growing season, the rains ceasing about the middle of October. Both plant and ratoon crops made good

progress up to this time, but neither quite came up to the crops of the previous year at the time the rains ceased, with the exception of one block of 60 acres of plant cane which was reclaimed 12 months previous to planting and green-manured in the meantime. This block was far and away above the average, a very excellent crop indeed, and shows what can be done given a fair chance. When harvested this block averaged about 30 tons per acre, some parts of it rising to as high as 34 tons.

The relative backwardness of the crops at this time may be accounted for, in the case of the ratoons, by the fact that the previous plant cane crop was very late harvested by reason of delay in completion of the factory, and in the case of the plant cane by the shortness of rain in the three months following planting out. Considering, however, that over most of the area under cane planting so closely followed reclamation from howling jungle, there being an interval of only 2 to 3 months in between, it is surprising that the crops make the growth they do.

As compared with the previous year ripening was slightly retarded, but as the figures given later show, the ratoons were fully ready to commence work on early in December, and, had the factory been ready, work on the ratoons could probably have been advantageously commenced during November. The plant cane ripened off a little later. In both plant cane and ratoons, Striped Mauritius and B. 376 ripened off first followed by B. 147.

Harvesting was commenced very late, *i.e.*, at the end of February 1918, and continued intermittently throughout March, the cane, as last year, being supplied to Mr. Maxwell, being sold to him on a sliding scale based on its sucrose content and the price obtained for the sugar manufactured. The *gur* factory of the previous year had in the meantime been under conversion by Mr. Maxwell into a factory for the manufacture of white sugar direct from the cane. This however was not completed in time to deal adequately with the crop. In the result only some 390 tons of cane were dealt with in the factory, as compared with 775 tons last year, the bulk of the remainder of the crop being thrown away, some being used for planting and distribution. This is a very deplorable state of affairs indeed, more particularly as it is the second year in which the greater part of the crop by far has been utterly wasted. It is hoped that the crop now on the ground will not be similarly lost during the coming milling season.

Not only have our crops been thus practically wasted for two successive years, but in both years the great delay in com-

mencing milling has kept the crops standing on the ground so late in the season as not only to prejudice the succeeding ratoons but to seriously inconvenience the normal working of the farm.

*Outturn of cane.*—We have again to record and regret the fact that owing to a combination of adverse circumstances similar to those which obtained during the previous milling season (*vide* page 5, report for 1917), and the chief of which were not under our own control, it is quite impossible to say exactly what the total crop was, as it proved out the question to weigh it all. The cane entering the factory was weighed but as this was almost entirely derived from one block of cane, the figures are only of value in relation to that block.

However, an effort to estimate the crop was made by weighing a measured average acre in one or two different places in the middle of each block under cane. The actual weighments recorded appear in Table I.

TABLE I.

Block No.	Area weighed.	Weight cane stripped for milling.	Variety.	Plant cane or ratoons.	Remarks.
1	2	3	4	5	6
3	1 acre ...	Tons. 11'06	B. 376 ...	} Ratoons ...	The great delay, due to the incompletion of the factory, in commencing the harvesting of the previous year's plant cane undoubtedly had an adverse effect on the weight of this year's ratoon crop, which should have averaged at least 10 tons per acre.
	1 acre ...	10'8	S. M. ...		
4	1 acre ...	12'1	} B. 147 ...		
	1 acre ...	13'0			
5	1 acre ...	11'7	Mixed varieties	39 acres each of ratoons and plant cane.	The plant cane on Blocks 7, 8, 9 and 10 suffered much as a result of a great shortness of rain in the three months previous to planting out, which undoubtedly reduced the crop for reasons explained in paragraph 13 of last year's report.
6	1 acre ...	34'0	B. 147 ...	} Plant cane ...	Block No. 6 which averaged about 30 tons of cane per acre all over was, unlike the remaining blocks, reclaimed 12 months previous to planting out and was more over green-manured and kept in cultivation in the meantime. It shows, I think, what may be expected under conditions such as may be expected to obtain all over in future.
	1 acre ...	25'0	Mixed varieties.		
7	1 acre ...	14'2	S. M. ...		
8	1 acres ...	14'1	S. M. ...		
9	1 acre ...	15'2	B. 147 ...		
10	1 acre ...	12'3	B. 376 ...		

Taking the figures for each block to be fairly representative of the whole block, by computation we arrive at an average yield for the whole area under cane of almost exactly 15 tons per acre.

Much bigger crops than this may confidently be expected in future years in my opinion; the ratoon crop should have been bigger had it been possible to harvest the previous plant cane crop earlier, and the plant cane crop was short as a result of the drought which followed planting in 1917 as explained in paragraph 13 of the report for 1917.

*Quality of cane.*—Analysis of the canes was commenced early in December 1917 and continued intermittently until the factory closed down at the end of March 1918.

*Preliminary Analysis.*—Previous to the actual factory operations in March, analyses were made on average samples of cane taken direct from the field.

The results appear in Table II. The figures show the sucrose content of the juice and also of the cane for both plant canes and ratoons of the three varieties of cane grown and serve to illustrate the progress of ripening. Thus the ratoons from Blocks I to IV were first analysed during the early part of December and again at the end of December, and all the figures show that ripening had proceeded well during the intervening period.

Similarly the plant canes from Blocks VI to X were analysed first during the last half of December, and again after 16 or 17 days, and the figures again show that the canes had ripened off considerably during that time.

The ratoons ripened off first as usual, and the figures for sucrose percentage and purity of juice show that they were certainly ready to commence milling early in December at any rate, though of course not then fully ripe.

The plant canes at that time were not so ripe, but were all showing a purity of over 80 per cent which was increased to nearly 90 per cent, by the second week in January 1918. Had ratoon harvest commenced in December, by the time that it was finished the plant cane crop would have been fully ready to follow on.

As between the three varieties, in both plant cane and ratoons it will be seen that B. 376 and Striped Mauritius ripened off earlier than B. 147, which is rather a late cane.

*Factory Analysis.*—During the 15 days or so when the factory was actually working during March 1918, to meet the desire of the Factory Manager that the normal working of the factory should be interfered with as little as possible, a scheme of analysis

was carried out from which it was hoped to obtain a fair average figure for the sucrose content of the cane milled. This included daily estimations of the fibre content of the cane brought to the factory the previous day, analysis of the various mill juices, mill bagasse, etc.

The results show that, on the average, for every 100 parts of cane milled there resulted only 64·31 parts of juice containing 17·04 per cent. sucrose, and 35·69 parts bagasse with a sucrose content of 7·86 per cent.

TABLE II.

Block No.	Date.	Variety.	Juice expressed.	Sucrose in juice, Per cent.	Purity of juice, Per cent.	Sucrose in bagasse, Per cent.	Sucrose on cane, Per cent.	Remarks.
I	2	3	4	5	6	7	8	9
I	10th December 1917	Mixed ratoons ...	70 per cent.	15.59	90.8	7.10 per cent.	13.04 ...	Ratoons. (First half December 1917). Progress of ripening is shown by comparison of these figures with those for the same blocks made some 17 days later and given below.
II	12th December 1917	- Ditto ...	74 per cent.	15.21	86.4	8.10 ...	13.36 ...	
III	15th December 1917	Striped Mauritius and B. 376 ratoons.	74 per cent.	15.64	88.9	7.03 ...	13.40 ...	
IV	18th December 1917	B. 147 ratoons ...	73 per cent.	14.50	83.6	6.07 ...	12.22 ...	
V	24th December 1917	Mixed plant cane and ratoons.	73 per cent.	14.47	84.6	7.00 ...	12.45 ...	
VI	20th December 1917	Mixed plant canes...	74 ...	14.09	87	5.50 ...	11.86 ...	Plant canes. (Latter part 1st December 1917). Compare these figures with those given below for analyses made some 16 or 17 days later on the same blocks.
VII	22nd December 1917	Striped Mauritius plant cane.	74 ...	14.15	86.1	7.16 ...	12.33 ...	
VIII	24th December 1917	Ditto ...	75 ...	13.85	83.6	5.58 ...	11.78 ...	
	25th December 1917	B. 147 plant cane...	75 ...	12.83	80.1	5.85 ...	11.09 ...	
	26th December 1917	B. 376 plant cane...	74 ...	14.68	87.9	7.40 ...	12.79 ...	

TABLE II—*contd.*

Block No.	Date.	Variety.	Juice expressed.	Sucrose in juice. Per cent.	Purity of juice. Per cent.	Sucrose in bagasse. Per cent.	Sucrose in cane. Per cent.	Remarks.
1	2	3	4	5	6	7	8	9
I	27th December 1917	Mixed ratoons	74	16.25	90.6	Not estimated.	(13.93)...	Ratoons. (End December 1917).
II	28th December 1917	Ditto	73	15.72	91.4	Ditto	(13.48) ..	
III	31st December 1917	Striped Mauritius ratoons.	74	16.96	91.2	Ditto	(14.54)...	
III	1st January 1918	B. 376 ratoons	74	16.81	91.2	Ditto	(14.41) ..	
IV	2nd January 1918	B. 147 ratoons	73	16.17	88.2	Ditto	(13.86) ..	Plant canes. (Early January 1917).
V	3rd January 1918	Mixed plant cane and ratoons.	73	13.74	81.2	Ditto	(11.78)	
VI	4th January 1918	Mixed plant canes	75	13.99	86.4	Ditto	(11.99) ..	
VII	5th January 1918	Striped Mauritius plant cane.	76	15.72	91.4	Ditto	(13.47) ..	
VIII	7th January 1918	Ditto	73	15.59	89.4	Ditto	(13.37) ..	Plant canes. (Early January 1917).
IX	8th January 1918	B. 147 plant cane	73	14.76	86.3	Ditto	(12.65) ..	
X	9th January 1918	B. 376 plant cane	74	16.33	92.3	Ditto	(14.6) ..	

This gives an average sucrose content of cane milled of 13.76 per cent.

In my opinion this figure is below the truth for our canes milled in the month of March, partly by reason of the fact that in many cases an interval of a few days occurred between delivering the cane at the factory and milling it.

In view also of the fact that a minimum expression of 70 per cent. of juice on weight of cane is always obtained with our canes using a small three-roller bullock mill (*vide* Table II), and that the 9 roller factory mills gave last year an expression of 70 per cent., it seems to me to be highly improbable that the figure of 64.3 per cent. derived from the factory records this year can be correct.

On the whole, very little information of either interest or value to the experiment is derivable from the records of the factory operations for the year under review.

12. *Extension area, season 1917-18.*—Reclamation commenced from the latter part of October 1917 and went on into April 1918. The total new area brought under cultivation was 155 acres. In addition 108 acres of land reclaimed last year were re-ploughed, cultivated, harrowed, drained and trenched. The operations consisted of the harrowing down of grass jungle previous to burning off; ploughing, harrowing, cultivating twice followed by re-harrowing, draining and trenching for planting. The whole of the area was drained, as per scheme described in paragraph 11 of the report for 1916, previous to planting up.

13. *Planting of present crop.*—Planting commenced earlier than in former years, *i.e.*, towards the latter end of January and was not finished until the end of April 1918. In all some 233 acres new cane was planted, about 108 acres of this in Blocks 11 and 13 having been reclaimed 12 months earlier, the remaining 125 acres being reclaimed just previous to planting up. Of the land ploughed up 12 months previous to planting, Block No. 11 had in the meantime gone back into jungle it being found impossible to work it in the rains; Block No. 13 was kept however in a fair state of cultivation throughout.

The total area under cane this year, plants and ratoons, amounts to just over 500 acres.

This year the precaution was taken of planting out reserve nurseries along the roadside for filling in vacancies later. On the whole germination this year is much better than last, and the young crop is doing well up to date and is well forward, with the exception of two blocks, Nos. 17 and 18, which were planted out very late at the end of the season.



The varieties of cane under cultivation are Striped Mauritius, and Barbadoes Nos. 147 and 376.

Up to the end of June, the ratoons had all been twice hoed, and the young plant cane twice weeded.

Up to the present crop prospects are more favourable than they were last year, and in the ordinary course of events bigger crops may be confidently expected.

14. *Cane nursery*.—Some 15 varieties were grown in the nursery including Dr. Barber's red sport of striped Mauritius, Kamrup red sport of striped Mauritius, Java 247, Java 33a, Barbadoes Nos. 208, 6450, 3412 and Barbadoes A and B (numbers uncertain), White Bombai, Tanna, and W. M. Nos. 1, 2, 3 and 4.

Of the above Dr. Barber's red sport and Java 247 did very badly indeed for the second time and have been rejected as useless. The remaining 13 varieties are being nurseried again on a bigger scale this year, in addition to two other new varieties introduced last year by Mr. Maxwell, making 15 new varieties in the nursery in all in 1918.

The varieties showing most promise at present are, B 208, B 6450, B. 3412, J. 33a, Barbadoes A, White Bombai, Kamrup red sport of striped Mauritius, W. M. Nos. 2 and 3. Some of these will be planted out on a field scale in 1919.

15. *Other crops*.—The only other crops grown were *Dhaincha* (*Sesbania Aculeata*) and Java Natal Indigo, both of which were grown for seed purposes.

*Rain crops, 1918*.—*Dhaincha* and cowpeas (*Vigna Catiang*) are being grown as green-manure crops on those blocks which came out of cane last season. In addition further areas are under *Dhaincha* and cowpeas for seed for next year's green-manuring programme.

About 2 acres of bamboos have been planted out, and nurseries of Nim and Gold Mohur trees commenced with a view to the provision of fuel.

16. *Expenditure*.—From 1st July 1917 to the 30th June 1918.

*Kamrup Sugarcane Farm.*

Heads.	From 1st July 1917 to 31st March 1918.	From 1st April 1918 to 30th June 1918.	Total.
1	2	3	4
<i>Establishment.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Manager ... ..	8,800 0 0	3,000 0 0	11,880 0 0
Clerks ... ..	675 0 0	225 0 0	900 0 0
Compounder ... ..	270 0 0	90 0 0	360 0 0
Peons ... ..	270 0 0	90 0 0	360 0 0
Tackle Assistants ... ..	1,714 8 0	547 0 0	2,261 8 0
Muharrirs .. ..	405 0 0	135 0 0	540 0 0
Sugar Analyst ... ..	150 0 0	100 0 0	250 0 0
Total ... ..	12,364 8 0	4,187 0 0	16,551 8 0
<i>Special Contingencies.</i>			
Implements, machinery, etc. ... ..	3,609 11 0	51 0	3,660 11 0
Buildings ... ..	500 0 0	...	500 0 0
Fencing ... ..	...	1,155 8 0	1,555 8 0
*Breakage of machinery ... ..	5,505 12 0	...	5,505 12 0
*Dismantling and transport of machinery. ... ..	19,408 5 0	...	19,408 5 0
Total ... ..	29,023 12 0	1,606 8 0	30,630 4 0
<i>Regular Contingencies.</i>			
Feed of cattle ... ..	2,754 14 0	...	2,754 14 0
Seeds, plants and manures ... ..	313 6 0	8 7 0	321 13 0
Wages of labourers ... ..	24,346 1 0	11,732 12 3	36,078 13 3
Petty repairs... ..	4,751 4 10	66 0 0	4,817 4 10
Service postage ... ..	100 0 0	...	100 0 0
Unspecified charges ... ..	419 9 6	277 8 6	697 2 0
Cost of fuel ... ..	1,701 14 0	14 0	2,202 12 0
*Ditto ... ..	5,057 14 0	...	5,057 14 0
Stores, oil, etc. ... ..	1,774 3 0	...	1,774 3 0
Total ... ..	41,219 2 4	12,585 9 9	53,804 12 1
Grand total ... ..	82,607 6 4	18,379 1 9	1,00,986 8 1

\* Items marked thus constitute special expenditure, sanctioned by Government to Mr. W. Maxwell in connection with the Factory, and amount to a total of Rs. 29,971-15-0.

*Receipts.*

			Rs.	a.	p.
By sales of sugar and sett:	...	...	718	6	0
By sale of cane to factory	...	...	2,063	0	0
Total	...	...	2,781	6	0

17. *Staff.*—The staff during the year consisted of—

			Rs.	
Manager on	...	...	1,000	per mensem.
Clerk on	...	...	75	"
Engine staff	{	One mistry on	55	"
		Three Engine drivers on	22	"
		Three 2nd Engine drivers on	18	"
		Two Engine attendants on	15	"
		One godown muharrir on	20	"
		One " " "	25	"
		One compounder on	30	"
		Three peons on	10	"

18. *General.*—The Director of Land Records and Agriculture, Assam, and the Deputy Director of Agriculture, Assam Valley, visited the farm frequently throughout the year.

The general health has been good.

CAMP KAMRUP FARM, }  
The 17th July 1917. }

A. A. MEGGITT,  
*Acting Deputy Director of Agriculture,*  
*Assam Valley.*

REPORT ON AGRICULTURAL DEMONSTRATIONS IN  
THE UPPER ASSAM VALLEY FOR THE YEAR  
ENDING 30<sup>TH</sup> JUNE 1918.

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*Staff.*—Maulvi Fazlul Haq Ahmed, Superintendent of Agriculture, was in charge, assisted by two Inspectors and five demonstrators, one of whom however was only appointed on 1st June 1918. During the year the Superintendent of Agriculture was on tour for 246 days.

Sreejut Devi Prasad Gohain was placed in charge of the Sibsagar district after a preliminary training under the Kamrup Inspector, from the 15th November 1917, as Inspector, when Sreejut Golok Chandra Bora was transferred to Nowgong. He was on tour for 230 days.

Agricultural Inspector Sreejut Golok Chandra Bora was absent on 1 month's privilege leave during the year, and was on tour for 274 days.

2. *Demonstration work.*—Demonstrations were continued on :—

*Paddy.*—Manuring and variety demonstrations.

*Sugarcane.*—Distribution of superior varieties, green-manuring for cane, and the use of the three-roller iron crushing mill.

*Potatoes.*—Distribution of superior varieties.

*Meston ploughs.*—Use of.

*Conservation of cattle manure.*—Construction of covered pits.

*New crops.*—Trials of and distribution.

3. *Paddy.*—*Residual effect of bonemeal.*—Eight plots originally manured with bonemeal in 1915 were observed for 3rd year residual effect. The 1st and 2nd year's results appeared in

the two previous reports. The 3rd year results were as follows :—

*Sibsagar District.*

No.	Locality.	Grain in lbs. per acre.		Remarks.
		Bonemeal plots.	Untreated plots.	
1	2	3	4	5
1	Kachojan ... ..	Grain pilfered.		Rejected.
2	Parbatia ... ..	1,612	1,524	
3	Khongia ... ..	1,488	1,167	
4	Kakotigaon ... ..	1,423	1,225	
5	Ahomgaon ... ..	1,736	1,279	
6	Gorokhiya-dowl ... ..	1,242	1,344	
7	Dhai Ali ... ..	1,864	1,542	
8	Dheporgaon ... ..	1,154	1,222	

The average increase per acre of the bonemeal plots over the untreated plots is 174 lbs. grain.

Valued at Rs. 3 per maund (82 lbs.) this shows an average net profit of Rs. 6-6-0 per acre for the third year. The total net profit for the three years of the demonstration works out of Rs. 18-6-0 per acre; the initial expenditure for bonemeal in 1915 was Rs. 9 per acre, so that for an outlay of Rs. 9 per acre the cultivator may confidently expect to realise a net profit for Rs. 15 during the following three years. This confirms previous results.

4. *Second year paddy demonstrations.*—These were commenced in 1916 at several centres, one plot being then manured with either bonemeal or flour phosphate, 3 maunds per acre, the other being a check plot. The 1st year's results appeared in paragraph 50

last year's report. The second year's outturns, without further manure, are as follows :—

*Sibsagar District.*

No.	Locality.	Grain per acre, in lbs.		
		Bonemeal plots.	Flour phosphate plots.	Untreated plots.
1	2	3	4	5
1	Dergaon ... ..	...	1,157	984
2	Rahdhola ... ..	1,387	...	1,453
3	Parbatia ... ..	...	1,403	806
4	Murabazar ... ..	...	1,354	1,057
5	Bhojo ... ..	1,520	...	1,273
6	Longkak ... ..	972	...	848
7	Meleng ... ..	...	1,346	1,353
8	Patiagaon ... ..	...	1,045	1,353

The average increase due to bonemeal was 102 lbs. grain per acre, and to flour phosphate 150 lbs. per acre over corresponding unmanured plots. This again bears out our previous experience in the Sibsagar district that flour phosphate gives better results than bonemeal on the average; see reports for 1916 and 1917. Whereas however flour phosphate was previously cheaper than bonemeal, it is now more expensive.

Reckoning the value of paddy at Rs. 3 per maund, the value of the increase due to bonemeal averages Rs. 3-12-0 per acre, while for flour phosphate it amounts to Rs. 5-10-0.

For the first year of these demonstrations, charging the whole cost of the manuring against the first crop, the result was a loss of Rs. 2 per acre in the case of bonemeal against a profit of Re. 1 per acre for flour phosphate. The net profit therefore for the first two years of these trials averages only Re. 1-12-0 in the case of bonemeal and Rs. 6-10-0 for flour phosphate. This is not such a good result as has been previously obtained in similar series of demonstrations; it is certainly in my opinion not good enough to tempt the cultivator to lay out his money in these manures.

5. *New paddy demonstrations.*—During 1917 in each sub-division one new bonemeal demonstration was commenced, while new flour phosphate trials were started at two centres, one in the Jorhat and one in the Golaghat subdivision. At each centre one plot was manured with bonemeal or flour phosphate, 3 maunds per acre, the other being a check plot.

*Sibsagar District.*

No.	Locality.	Grain in lbs. per acre.		
		Bonemeal plots.	Flour phosphate plots.	Check plots.
1	2	3	4	5
1	Jalukani ... ..	1,902	...	1,603
2	Halikihat—Ahomgaon ...	1,914	...	1,798
3	Bailung ... ..	1,851	...	1,539
4	Napomua ... ..	...	1,686	1,612
5	Amolapaty ... ..	...	1,357	990

On the average, the increase due to bonemeal is 242 lbs. per acre of paddy valued at Rs. 9, and due to flour phosphate is 230 lbs. paddy per acre, value Rs. 8-4. Current cost including freight charges is about Rs. 3-4-0 per maund for bonemeal and Rs. 3-10-0 for flour phosphate. Thus the cost of neither manure is quite recovered on the first crop, there being a small loss of 12 annas per acre for bonemeal and Rs. 2-10-0 in the case of flour phosphate.

The second and third years' crops without further manure should show a fair profit.

6. *Combined phosphate and green-manure demonstrations for paddy.*—During 1917 combined experiments in the use of phosphates with and without green-manure were commenced at four centres in the Sibsaḡar district. At each centre there were six plots, *viz.*, no manure; green-manure; bonemeal; flour phosphate; bonemeal *plus* green-manure; flour phosphate *plus* green-manure. The plots were all about equal in size averaging  $\frac{1}{6}$ th acre each. The manures were applied before sowing the green crop which was ploughed in a week or two before transplantation of the paddy.

The results recorded were as follows :—

*Grains in lbs. per acre.*

No.	Locality.	Unmanured plot.	Bonemeal.	Bonemeal plus green-manure.	Flour phosphate.	Flour phosphate plus green-manure.	Green-manure.
1	2	3	4	5	6	7	8
1	Kakojan ... ..	923	1,553	1,705	2,025	1,703	1,560
2	Kowarpur ... ..	1,492	2,058	2,014	1,884	1,850	1,811
3	Sukanpukhari ... ..	838	...	...	1,325	1,427	1,248
4	Batlasi ... ..	1,017	2,877	2,323	3,049	2,093	1,219

The results are somewhat inconsistent, and the increase due to bonemeal and flour phosphate is in most cases much more than has been recorded in the past with these manures. Such inconsistencies however must be expected in view of the fact that these demonstration centres have necessarily to be chosen in a more or less haphazard fashion and without any accurate previous knowledge of the history and treatment of the various plots.

Summing the results we arrive at the following :—

Average increase per acre for all centres due to	Grain, lbs per acre.
(a) Green-manure alone...	316
(b) Bonemeal ... ..	852
(c) Flour phosphate ... ..	1,002
(d) Bonemeal plus green-manure ... ..	870
(e) Flour phosphate plus green-manure ... ..	722

Though, while used alone, green-manure gives a very favourable average increase, when used with bonemeal or phosphate it does not appear from these results to add to the increase which these two manures give when used alone; indeed in the case of flour phosphate the average result is worse when used with green-manure than when used alone. The results at any rate appear to leave no room for doubt that phosphate in some form is the prime requirement of the paddy crop at these centres.



7. *Paddy variety demonstration*.—Two trials of Mr. Hector's "Indra" and one of "George" *sali* were made against local paddies of similar classes in each subdivision. The results are given below :—

Num-ber.	Locality.	PLOT num-ber.	Variety.	Yield of grain per acre.	Remarks.
1	2	3	4	5	6
				lbs.	
1	Baghmariagaon...	I	Indra sali	860	
		II	Suagmani	1,010	
2	Son rigaon ...	I	Indra sali	1,119	
		II	Jahinga	768	
3	Khelmati ...	I	George sali	1,846	
		II	Jal sali	1,483	
4	Halikihat Ahom-gaon.	I	Indra sali	1,274	
		II	Sokoa ...	1,053	
5	Jogigaon ...	I	Indra sali	1,594	
		II	Sokoa sali	1,370	
6	Simoluguri ...	I	Indra sali	2,330	
		II	Jahinga	2,563	
7	Serekapar ...	I	Indra sali	2,237	
		II	Rangabora	1,895	
8	Simoluguri ...	I	George sali	1,535	} Site unsuit- able for George sali.
		II	Ronga sali	2,181	

It will be seen that out of six trials *Indra sali* has beaten the local variety in four cases in the case of one centre No. 6 at Simoluguri, the site chosen was too low for *Indra sali*. Neglecting this centre, *Indra sali* has given an average increase of 208 lbs. paddy grain per acre over local varieties, though the yields at four centres are not comparable with the heavy outturns reported from Bengal for *Indra sali*.

*George sali* beat the local variety at one centre but not at another ; in the latter case the site was unsuitable, being too high for this variety which likes a fairly low site and fairly well of water.

A good many more trials of these varieties will be necessary in Assam before their superiority is definitely proved.

8. *Demonstrations with superior varieties of sugarcane.*—Two new demonstrations were started in each subdivision. The yields of *gur* per acre obtained, as well as those for the ratoons of the previous year's demonstrations, are given below :—

Nam. ber.	Locality.	Yield of <i>gur</i> per acre, in lbs.		Remarks.
		Improved canes.	Local canes.	
1	2	3	4	5
1	Goromur ... ..	5,566	4,866	Plant canes.
2	Arundhara ... ..	5,309	3,473	
3	Kamargaon ... ..	2,240	1,256	
4	Charingia ... ..	2,933	2,178	
5	Demow ... ..	1,825	1,455	
6	Namtali ... ..	1,403	1,563	
	Average yield ...	3,213	2,465	
	<i>Increase per acre plant cane ...</i>	748		
7	Khatoal ... ..	1,846	1,099	Ratoon crop.
8	Ahompathar ... ..	1,994	709	
9	Somdorgaon ... ..	1,640	798	
10	Chinatoli ... ..	1,256	575	
11	Barkathoni ... ..	1,029	877	
	Average yield ...	1,553	812	
	<i>Increase per acre—Ratoons</i>	741		

On the whole with one or two exceptions these results are poor, and lower than have been recorded from similar demonstrations in the past. While for both plant canes and ratoons the results show an average net profit per acre in favour of the introduced varieties of some Rs. 47, considerably higher outturns

should be possible. It is the fact that cultivators can hardly be persuaded to give our improved varieties of cane the better cultivation and little extra care and manure which they demand and will undoubtedly pay for. More particularly this applies to the ratoon crop, upon which ryots will usually spend no money in manure or labour in cultivation. It is my considered opinion that the mere distribution of improved varieties will effect little improvement in itself. Under the treatment at present meted out to them by the ryot these canes will degenerate.

Finally, I am convinced that unless we can persuade ryots (a) to put in more cultivation, (b) to adopt some sort of a rotation, including a green-manure crop once in four or preferably three years (c) to plant earlier, (d) to select carefully planting material and (e) to manure more heavily, there is little hope for much permanent improvement in cane culture in Assam amongst the cultivators.

*Green-manuring for cane.*—This was demonstrated at four centres, cowpeas being grown and hoed in in the year previous to planting cane, the local variety being grown on both the green-manured and check plots at each centre.

Number.	Locality.	Yield of gur in lbs per acre.		Remarks.
		Green-manured plot.	Check plot.	
1	2	3	4	5
1	Charaibahi ... ..	4,880	3,307	Kolapura cane.
2	Khongia ... ..	3,245	2,805	Magh cane.
3	Gharkatiya ... ..	5,475	5,293	Ditto.
4	Chinatoli ... ..	1,906	1,452	Ditto.
	Average ... ..	3,876	3,214	
	Increase due to green-manure...	662		

This increase of 662 lbs. *gur* per acre at Rs. 5 per maund is worth some Rs. 40, this profit being obtained at a cost of Rs. 4-8-0 per acre for Cowpea seed.

*Three-roller iron crushing mill.*—Seven of these mills were used throughout the district for carrying out demonstrations.

Practical tests of the mill were made at several centres against the ordinary country wooden mills, using an equal weight of cane for either mill, noting the time of crushing and weighing the juice and *gur* obtained. On the average the iron mills crushed a given weight of cane in three quarters of the time that was taken by the country mill, and the increase in *gur* obtained amounted to 22 per cent. The average attendance of cultivators at these tests was 22.

*Distribution of cuttings of superior cane varieties.*—The demand for our canes is growing so fast, that to augment the supply of cuttings small centres for growing improved varieties were established by arrangement with cultivators in the districts.

The total number of cuttings disposed of for demonstration and distribution purposes was 309,000 derived as follows:—

Jorhat Farm	...	...	1,16,000
Demonstration centres	...	...	9,000
Srijut Deveswar Baribakur,	}	...	44,000
Thakurbari Farm			
Srijut Loknath Hazarika,	}	...	10,000
Panidihing.			
Srijut Deveswar Goswami,	}	...	5,000
Gossainbari Farm			
Kamrup Farm	...	...	1,25,000

It may be remarked that the varieties of cane we have been distributing now for the past few years, Striped Mauritius, B147 and B376, may now be found scattered over the districts, i.e., in the Bokota and Panidihing mauzas, Kakwa, Somdor and Metaka villages in Sibsagar, in the villages of Khongia, Arundhara and Parbatia, etc., in Jorhat, and in Kamargaon on the banks of the Dhansiri; in Gharkatiya and Badulipar; and in Bokajan, Seclonijan, Kerdeiguri and Naharancee in newly opened tracts in the Nambor Forests.

9. *Potatoes, superior varieties.*—Ten demonstrations were made to compare Shillong seed with Local bazar seed.

"Magaum Bonum" from the Shillong Farm was the variety used. The yields per acre were as follows :—

No.	Locality.	Shillong seed.	Local seed.
1	2	3	4
		Tons.	Tons.
1	Kakila-Kumargaon ... ..	4.0	3.1
2	Nokari-Bamungaon ... ..	2.9	0.7
3	Simoluguri ... ..	2.0	0.9
4	Kuarghat ... ..	6.0	1.7
5	Amguri ... ..	6.7	1.2
6	Kuarpur ... ..	1.7	2.0
7	Gelabil ... ..	1.8	1.0
8	Kamargaon ... ..	7.9	4.2
9	Mahuramukh ... ..	8.9	3.9
10	Gelabil ... ..	3.6	2.7
	Average ... ..	4.5	2.14

These ten demonstrations show an average increase of crop in favour of the Shillong seed of some 2.3 tons per acre which at Rs. 70 per ton represents a money value of Rs. 161 per acre. This is discounted to some extent by the fact that on account of the larger size of the Shillong seed and the objection on the cultivators' part to cutting them, much more seed of the Shillong variety is necessary to plant a given area. Thus to plant an acre of Shillong potatoes often costs Rs. 75 for seed alone, and if the potatoes are very large the amount would be more, whereas for small local seed the cost per acre for seed would not often exceed Rs. 10.

In spite however of this the demand for Shillong seed far exceeded the supply and many prospective buyers were disappointed. Some 113 maunds potatoes were sold for seed at Rs. 5 per maund in the Sibsagar district, whereas 500 maunds could easily have been sold had it been available.

10. *Meston ploughs*.—These ploughs were demonstrated in several centres with some success. Their cost seems to be against them in this district.

11. *Conservation of cattle manure*.—The construction of model manure pits in villages was continued. During the year 2 were erected in Jorhat, 91 in Golaghat and 32 in Sibsagar.

12. *Demonstration work done by Honorary Correspondents.*—Some of the Honorary Correspondents of the Department rendered valuable assistance in one way or another during the year, and our thanks are due to them for their interest in popularising our efforts.

Srijut Deveswar Barthakur and Srijut Deveswar Goswami who have been extensively cultivating our improved canes for some years helped us by distributing large numbers of cuttings to cultivators as mentioned previously in this report. The former carried out some very successful experiments with Joha paddy, a fine scented variety.

Srijut Narayan Barua distributed much "George sali" seed.

Maulvi Zubaid Ali Hazarika was very successful with Shillong potatoes; he also grew "George sali" and demonstrated the superiority of our Barbadoes sugarcanes on his farm.

Srijut Baikuntha Narayan Barua and Srijut Pithubar Saikia also experimented with paddy on their holdings.

Babu Jnan Chandra Roy considerably extended the cultivation of Barbadoes canes which have been giving uniformly good results. He also distributed a certain number of cuttings of Barbadoes canes free of charge to neighbours.

13. *Demonstration work in Nowgong.*—An opening was made with demonstration work in the Nowgong district during the year. No Inspector was available till towards the end of the year, for the greater part of which we had to work with one Demonstrator stationed at Kampur. Unfortunately this man proved utterly unreliable and was dismissed subsequently. Under the circumstances proper supervision being impossible, very little was effected.

*Paddy.*—Manurial and variety demonstrations on paddy were laid down, but the results for one cause or another proved quite unreliable. However the cultivation of "George" and "Indra" sali is extending, and "Boro" paddy was grown successfully in several localities in Uttarkhola mauza.

*Potatoes.*—To introduce this important crop five demonstrations were arranged. The crops did well, but were pilfered to such an extent from the plots that weighment was useless.

*Sugarcane.*—Small areas of Barbadoes canes were planted up at Dharamtul, Chaparmukh, Lanka and Kampur with a view to providing material for conducting proper demonstrations in the future. At the two former centres these failed through negligence on the part of the cultivators concerned; at Lanka

the crop was ruined by wild animals, while at Kampur a portion of the crop was ruined by an elephant and the remainder which grew excellently was completely lodged by a storm while immature. Some 18,000 cuttings were sent from Jorhat in April 1918, but these are again reported to have germinated badly from delay in transit and other causes. A scheme under which the Nowgong Jail was to grow 2 acres of our canes for future distribution fell through unfortunately at the last moment, owing to changes there connected with the outbreak of *hat* looting.

*Iron crushing mills for sugarcane.*—These three-roller mills were demonstrated at Atigaon, Charaihagi, Rangalu, etc. Iron mills of a two-roller type have however been in use in the district for some time; the three roller mill is however more efficient.

*Meston ploughs.*—This plough was demonstrated at Singrimari, Rangalu, Nijkampur and other centres.

*Conservation of manure.*—In this district covered sheds are being advocated, the country generally being too low for pits.

JORHAT :

The 23rd August 1918.

A. A. MEGGITT,

*Agricultural Chemist to the  
Assam Administration.*

## REPORT ON AGRICULTURAL DEMONSTRATIONS IN KAMRUP DISTRICT FOR THE YEAR ENDING THE 30TH JUNE 1918.

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The agricultural demonstration work in this district, together with the Seed Depôt, Gauhati, were in charge of Babu Satyendra Chandra Datta, Agricultural Inspector, Kamrup, throughout the year. He is under the guidance and control of Maulvi Abdul Fazlul Haque Ahmed, Superintendent of Agriculture, Assam Valley, and is assisted by three Demonstrators with headquarters at Nalbari, Gauhati, and Palasbari, respectively.

Satyendra Babu remained in charge throughout the year, except for a period of 45 days which he spent on 'privilege' leave, and a period of ten days in November, during which he visited the plains districts of the Garo Hills to advise on the possibility of *Boro* paddy cultivation there.

The third Demonstrator, Sheikh Umar Ali, was appointed to the Palasbari circle from the 1st of November last. The other two demonstrators, Srijut Biswa Nath Dutta and Srijut Chandi Charan Dutta, were confirmed in their appointments as demonstrators, Gauhati and Nalbari, respectively.

The Agricultural Inspector was on tour for 198 days.

2. Demonstration work was continued on similar lines to that of the previous year, and was extended to new portions of the district previously untouched. The points to which attention was principally devoted were :—

- (1) Manuring and variety demonstration with paddy.
- (2) Variety trials of sugarcane, and demonstration with three-roller iron mills, and distribution of cane sets of improved varieties.
- (3) Variety trials of superior varieties of potatoes and distribution of seed potatoes.
- (4) Jute demonstrations.
- (5) Trials of fodder and a few miscellaneous crops.
- (6) Introduction of Weston ploughs.
- (7) Conservation of cattle manure.

3. *Manuring of the rice crop.*—(1) This work was started in 1913, but the demonstrations begun in that year gave very irregular results and proved of little value. Demonstrations laid down each year since that time have given better results. The selected



lands were manured with bonemeal, at 247 pounds per acre, and the paddy crops weighed each year for three years, and compared with those of the neighbouring unmanured plots. A second application of bonemeal is being given at the end of the three years. This is for the purpose of testing whether or not the effect of the first application has been exhausted in that time, and if a second application will again produce a profitable increase in the crop.

At Chakchaka half of a plot, which was treated with bonemeal in 1913, was again redressed in 1916. The second year's results have been recorded, and shew an increase of 506 lbs. per acre from the second application, over that obtained from the plot originally manured in 1913.

Another plot at Parakuchi which received bonemeal in 1914 was again redressed in 1917. The first year's results have been recorded and shew an increase of 619 lbs. grain per acre from the redressed plot.

4. *Third year demonstrations.*—Five centres were manured with bonemeal in 1915 and were kept under observation since. Owing to the produce being mixed in one of these demonstrations the results had to be discarded. The remaining four gave the following results :—

*Yield of grain per acre, in pounds.*

—			Bonemeal plots.	Untreated plots.	Remarks.
1			2	3	4
1. Nalbari	...	...	898	676	Ahu crop only.
2. Gobindpur	...	...	583	478	Sali crop only.
3. Palasbari	...	...	1,115	891	Ditto.
4. Uparsali	...	...	1,553	1,122	Ditto.

The average increase per acre on the manured plots came to 245 pounds and, as there was a substantial profit in the first two years from the increase then produced, this series of demonstrations may be considered quite satisfactory.

5. *Second year demonstrations with green manure used alone and also in conjunction with bonemeal.*—Dhaincha was the green manure used, and bonemeal was applied at 247 pounds per acre. The results were as follows:—

*Yield of grain per acre in pounds.*

Locality.	Green manure plots.	Green manure and bonemeal.	Untreated plots.	Remarks.
1	2	3	4	5
Tongra ... ..	2,985	3,420	3,387	Sali only.
Ko ura ... ..	1,350	1,399	1,023	Ditto.
Nalbari ... ..	2,709	2,592	2,593	Ahu and sali.
Sorbhog ... ..	1,740	1,415	1,598	Ditto.

This shows an average increase of 45 pounds from the green, manure, and of 49 pounds from the combined application of bonemeal and green manure. As the increases were respectively 164 and 301 pounds in the previous year, the total increase for the two years amounts to 209 and 350 pounds, obtained by an expenditure of Rs. 1-8-0 for the green manure seed, and of Rs. 10-8-0 for the bonemeal and green manure. These demonstrations will be continued for a third year.

6. Similar demonstrations were started at Sandheli, Dharamtola, Nayagaon, Rangamati, Sarpara and Beltola, in the year under report. Results from five of these centres in the first year were as follows:—

*Yield of grain per acre in pounds.*

Locality.	Green manure.	Green manure and bonemeal.	Untreated.	Remarks.
1	2	3	4	5
Sandheli ... ..	1,880	2,059	1,830	Sali crop.
Dharamtola ... ..	1,751	1,766	1,525	Ditto.
Nayagaon ... ..	2,222	2,089	1,640	Ditto.
Rangamati ... ..	1,473	1,945	1,526	Ditto.
Sarpara ... ..	1,429	1,818	1,499	Ditto.

The average increase from green manure, costing Rs 1-8-0, is 183 pounds per acre and from the application of bonemeal and green manure, costing Rs. 10-8-0, the average increase per acre is 414 pounds. The somewhat irregular results detract from the value of these demonstrations, still at normal prices for paddy these would be satisfactory returns, and as considerable increases may be expected on the manured plots for another two years, the use of these manures is to be recommended.

7. *Manuring demonstrations with oilcake.*—These were tried at three centres with satisfactory results :—

*Yield of grain per acre in pounds.*

Locality.		Manured with oil cake.	Untreated.	Remarks.
1		2	3	4
Sandehli	...	2,222	2,019	Ahu and sali crops.
Dohali	...	3,533	2,735	Ditto.
Sadlipar	...	2,304	1,950	Ditto.

Oilcake was applied at approximately 500 pounds per acre, costing Rs. 10-8-0, and has produced the satisfactory increase of 462 pounds per acre. Oilcake is a home product available over the greater part of the district, and is usually sold to outside dealers at a very low price, instead of being fed to cattle or used directly as a manure. In view of the above satisfactory results, and with the hope of persuading the raiyats to abandon their present short sighted policy, we are extending these demonstrations in the present year.

8. *Demonstrations with improved varieties of paddy.*—Indra sali was tried against local sali at five centres, and George sali at six centres in the district, and the following results were recorded :—

Locality.		Indra sali.	Local sali.	Remarks.
1		2	3	4
Beltola	...	2,934	2,873	Produce mixed. Ditto.
Chutiapara	...	2,698	2,568	
Noonmati	...	2,127	1,811	
Baroma	...	...	...	
Doula	...	...	...	

This gives an average yield of 2,586 pounds per acre from Indra *sali* against 2,360 pounds of an average from the best local varieties.

Locality.	George sali.	Local sali.
1	2	3
Beltola ... ..	1,548	1,118
Changsari ... ..	2,510	2,002
Noonmati ... ..	2,585	1,993
Bilpar ... ..	1,760	1,773
Ruparbathan ... ..	1,995	1,778
Balikusia ... ..	1,683	532

The average yield from George *sali* in these tests shows an outturn of 2,005 pounds per acre, as against 1,151 pounds from the heaviest yielding local varieties.

The cultivators have been impressed with the superiority of these varieties to the local kinds, and a large demand for seeds is expected next year.

*Boro paddy*.—This variety of spring rice was introduced in the *rabi* season of 1915 from Sylhet, and since that time a small quantity has been grown in suitable districts. During the year 21 maunds 20 seers of *boro* seed paddy were sold in the district.

*Gandhi* and *panang*, late transplanted and late broadcasted paddy varieties, respectively, were procured from Bengal, and five maunds of these were distributed by the Deputy Commissioner to cultivators in mauza Katha, through Srijut Pratap Narayan Chowdhury, Mauzadar. In a few cases they have been successful. The special quality which commends these varieties to the cultivators is that they are late-growing varieties, and may be sown after the subsidence of flood water, when the season is too far advanced for the ordinary varieties.

A fine *aus* paddy, obtained from the Central Provinces five years ago, has been much appreciated by the cultivators who have tried it. As there is a steady (though comparatively small) demand for the seed, arrangements have been made to stock locally grown supplies in the Seed Depot.

9. *Demonstrations with superior varieties of sugarcane and improved cane crushing mills*.—At seven centres varietal demonstrations were carried out. Although considerable quantities of the best canes were pilfered from the plots of improved

varieties the yields were much greater than those obtained from the local varieties. Owing to late planting followed by drought, the crop at Nath Kuchi was poor and the comparative crushing test was therefore not carried out in this case. The results obtained at the other six centres were as follows:—

*Yields of gur in pounds per acre.*

Locality.	Improved variety.	Local variety.	Remarks.
1	2	3	4
Gabindpur ... ..	2,933 B. 376	973 Ratoon crop	
Dhervantala ... ..	3,156 "	1,792 Some canes.	
Changsari ... ..	4,416 "	3,357 Pilfered	
Murara ... ..	1,880 Strip e d Mauritius.	251 "	
Kathiameri ... ..	3,025 "	2,857 "	
Kamalpur ... ..	3,800 Strip e d Mauritius B. 147	3,526 "	
Bangamati ... ..	1,910 B. 376	1,051 ...	
Nath Kuchi ... ..	... ..	... Crop failed.	
Average yields ...	2,932 ...	1,972 ...	

This increase of almost 50 per cent. is very satisfactory indeed. The system of taking a Ratoon crop from sugarcane has never been generally adopted by cultivators in this district, because most of the Deshi canes only give a small number of shoots in the second year. As a result of this character of the country canes, the usual system is to take only the one crop and to plant afresh each year.

Our demonstrations with the improved canes have shown that, not only can a much better crop be obtained in the first year, but that an excellent Ratoon crop can be grown in the second year, provided the sets are properly planted at the beginning, and that they get a reasonable amount of cultivation and manuring.

Cultivators are slow to adopt the ratooning method as it is contrary to custom, and, therefore, any ratoon crop must be well

fenced and protected from cattle if it is to have a reasonable chance of success.

The improved canes used were Striped Mauritius, B 147, and B 376. The superiority of these varieties to local kinds has now been thoroughly established in all parts of the district, where we have been able to carry out demonstration work. This is proved by the fact that in 1915, 13,000 cane sets were sold, in 1916, 65,008, and in 1917, 1,14,600. Even a larger number could have been disposed of had sufficient funds been available. In order to increase the supply of sets next year, and to economize in cost of carriage and handling, a system of giving sets to cultivators, who would undertake to return an equal number in the following season, was adopted. In addition to the sets sold and distributed as above, 14,000 sets were given free for demonstration purposes.

10. *Demonstrations with iron three roller cane-crushing mills.*—The demonstration were continued successfully with five mills, and in addition 8 mills were sold in the district. Previously these mills could be sold at Rs. 65, but last year the price rose to Rs. 80, and as it seems likely to be higher in the present year, sales are not likely to expand.

*Distribution of Shillong potatoes.*—(1) Nine demonstrations were laid down to compare seed potatoes as supplied by the Upper Shillong Farm with local and Khasi mixed seed as ordinarily sold in the bazars. Although at several centres our improved varieties suffered from pilfering, the yields were greater in every case than those of the local or Khasi mixed seeds. The results from six centres were :—

*Yields in pounds per acre.*

Locality.	Shillong seed.	Local seed.
1	2	3
Agytari ...	16,123 King of potato	15,488 Khasi mixed.
Raha ...	19,841 "	17,746
Sorbhag ...	12,831 "	5,973 Deshi.
Gabindpur ...	14,560 "	9,059 ,
Nath Kuchi ...	5,581 "	1,704 "
Sandheli ...	6,891 "	8,717 Patnai.
Average ...	12,641	8,948

These demonstrations show in every case an increase of crop in favour of the Shillong seed, the average increase being 2,696 pounds,—1·6 tons. Valuing the increase at Rs. 63 per ton this gives an increased money value of Rs. 100 per acre.

(2) *Potato-spacing experiments and experiments with different sized seed potatoes.*—Two of each of these experiments were arranged but the results are not conclusive. A larger number of such experiments will be laid down in the coming year.

(3) *Distribution of superior varieties of seed potatoes.*—About 100 maunds of seed of the Shillong varieties were sold to cultivators in the district at a cash price of Rs. 5 per maund. This price only just covered the cost of sacks, freight, and actual cost of distribution, and allowed Shillong bazar price for the potatoes.

12. *Jute demonstrations.*—Further trials with **Kakaya** Bombai and Assam Barpat, selected by R. S. Finlow, Esq., Fibre Expert, Bengal and Assam, were carried out to compare these with local varieties. The results were as follows:—

*Yields of Fibre in pounds per acre.*

Locality.			Local variety.	Selected variety.
1			2	3
Sadilapar	...	...	1,142	2,011 Kakaya Bombai.
"	...	...	...	1,617 Assam Barpat.

The demand for the seed of Kakaya Bombai jute was much greater last year than in previous years. Being unable to get sufficient seed from the Bengal Department for our requirements in 1916, arrangements were made with local gentlemen to grow seeds of this variety for distribution. Maulvi Tayab Ali, Honorary Correspondent of the Department, and Babu Jyotish Chandra Chakravarty were sufficiently enterprising and public spirited to undertake this work, and the thanks of the Department are due to them for supplying a sufficient quantity of seed for almost the whole of the past year's requirements in this district.

A number of half-pound packets of this improved jute seed was distributed through the Deputy Commissioner, by means of the village organizations recently established in the district. This method has the double advantage of popularizing the improved jute and of bringing the village authorities in touch with Agricultural improvements.

13 *Trial of fodder and miscellaneous crops.*—A mixture of jowar and cowpeas was grown successfully at Rampur. Cowpea gave fair crops at Sorpara, Dohali and jowar at Jhalukbari and Barbhala. The cultivators do not yet show any interest in the cultivation of fodder crops.

Pusa wheat No. 6 was tried at two centres. At one centre the crop was injured by cattle, and at the other by insects, so no crop was obtained. A crop grown at Nilpur from bazar seed gave an outturn equivalent to 1,121 pounds per acre. Barley, masur, sonamug gave 607, 345 and 330 pounds per acre, respectively.

Gram was tried at three centres and proved unsuccessful. Mustard demonstrations were seriously damaged by aphides and gave no satisfactory results.

Cotton was formerly grown in the district to a certain extent but gradually went out of cultivation in recent years. Owing to the increase in price of yarns and cloths, great interest is being exhibited by local people in the possibility of a revival and extension of its cultivation. Although it is not likely that the cultivation of this crop will ever reach important proportions in the district yet it was considered desirable that arrangements should be made to procure seed for interested parties. Garo cotton, barkapas and juti kapas seeds were supplied to cultivators in the district, principally at Nalbari and Kamalpur.

14. *Introduction of Weston Ploughs.*—Demonstrations were continued with success, and nine ploughs were sold during the year. Owing to recent increases in price the sale of these implements is not likely to extend so rapidly as it otherwise would have done. A few plough shares were sold during the year, which shows that the ploughs already purchased have not been kept idle.

15. *Conservation of cattle manure.*—Thirty-two covered cattle manure pits were prepared in the past year. Twenty-eight of these were erected by the influence of Demonstrator Srijut Biswa Nath Dutt, and two each by Demonstrators Srijut Chandi Charan Dutt and Sheik Umar Ali. In Bhajali circle the necessity for erecting covered pits is not felt, as the cultivators keep their cattle on a machan (bamboo platform) and allow the manure to accumulate below until it is removed to the land. Credit is again due to Demonstrator Srijut Biswa Nath Dutt who has continued to show energy and activity in developing this work.

Shillong,

The 6th September 1918.

J. W. McKAY,

Deputy Director of Agriculture, Assam.



**REPORT ON AGRICULTURAL DEMONSTRATIONS IN  
KHASI AND JAINTHIA HILLS AND GARO HILLS DIS-  
TRICTS, FOR THE YEAR ENDING THE 30TH JUNE,  
1918.**

1. During the year U Harry Singh was in charge of the Demonstration work in the hills. He was assisted by four demonstrators, headquartered at Shillong, Mauphlung, Umran and Jowai, respectively, and by one demonstrator with headquarters at Tura in the Garo Hills.

2. *Rice*.—The majority of rice-growers in the district have realised the value of bonemeal for wet-land paddy. Fresh demonstrations have therefore been reduced from 5 in the previous year, to 2 in the present year. As in previous years two plots, each about  $\frac{3}{4}$  acre in area were taken at each centre. One was manured with bonemeal at the rate of 247 lbs. per acre, and the other left untreated as a check.

The first year's results are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Myntbloo	Sahmaji	1,093	712	381
2	Pamra	Myllow Dykhar	1,200	705	495
		Average yield per acre.	1,146½	708½	438

The average increase in crop due to bonemeal is, therefore, 438 lbs. per acre. Valuing this grain at Rs. 3 per maund of 80 lbs. and the bonemeal at Rs. 4-8, the net profit per acre works out at Rs. 2-14-9 for the first year of application. Any increase obtained in subsequent years will be pure profit, and experience shows that bonemeal favourably affects the crop for

at least three years. These plots are being kept under observation as to the second and third years' results of the initial dressing of bonemeal.

*Second year demonstrations.*—The five demonstrations laid down in 1916, of which the first year's result appeared in last year's report, were kept under observation without further manuring, and the results of the second year appear below :—

No.	Locality.	Cultivators.	Yield of grain per acre.		Increase in lb. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Nongthymmai ...	U Nori ...	1,212	908	304
2	Lumpengdeng ...	U Hinmoney ...	1,533	1,215	318
3	Mawthoh ...	U Khai ...	1,913	1,548	365
4	Um-iap ...	Ka Nesi ...	1,296	1,071	225
5	Myriaw...	Siem Myriaw ...	1,218	1,001	217
		Average yield per acre.	1,434	1,148	286

This average increase of 286 lbs. is worth Rs. 10-11-7 at current prices.

These demonstrations yielded an average net profit of Rs. 3-9 per acre in the first year, after charging the entire cost of bonemeal to that year. The total net profit per acre from the first two years of this series of the demonstrations, therefore averages Rs. 14-5-5.

*Third year demonstrations.*—The 20 centres commenced in 1915, of which the first and second year's results appeared in the reports for 1916 and 1917, were kept under observation for the third year. At five centres the demonstrations were injured by floods, and in one centre not cultivated through the owner's illness, and they are therefore neglected.

The following yields were obtained from the remaining fourteen demonstrations :—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mawsyirih	Mrival	...	...	Not cultivated.
2	Umjapung	Klat	1,023	1,241	218
3	Umselang	Poet	1,590	1,491	99
4	Umsaw	Biang	1,748	1,608	140
5	Mawrong	Kpa Ka Sen	1,350	1,163	187
6	Nonglekhiat	Bha	1,050	909	141
7	Mawsiatkhnem	Kalicharan	1,004	900	104
8	Umthuh	Nimor	...	...	Damaged by flood.
9	Rambras	Hari Siem	1,112	1,004	108
10	Nonspeng	Kpa Silibon	852	760	92
11	Nongur	Kir Lyngdoh	1,294	1,080	214
12	Laitdom	Morkin	1,170	1,009	161
13	Khliehtyrshi	Kpa Manik	897	619	278
14	Rambrai	Wanboreh	703	603	100
15	Kyndongtuber	Kpa Ka Ksel	1,080	900	180
16	Mawdemnai	Kpa Isaiah	1,520	1,360	160
Average yield per acre.			1,214	1,053	161

These fourteen centres show an average increase of 160 lbs. of grain from the plots manured with bonemeal. This at current rates is worth Rs. 6. These centres showed an average net profit per acre of Rs. 19-2-7 for the first two years. The total net profit for the three years for which these demonstrations have been carried on is, therefore, Rs. 25-2-7, on an initial expenditure of Rs. 15 per acre.

During the year fresh demonstrations with bonemeal for upland paddy have been carried out in 12 centres, ten centres being situated in the Jowai subdivision and one centre in each of Mauphlang and Shillong circles. The selected plots were as nearly as possible  $\frac{1}{4}$ th acre each. One plot was manured at the rate of 247 lbs. per acre and another was left untreated for comparison.

The results of the demonstrations at two centres, *vis.*, at Umpyut and at Mawstem were not recorded.

The results obtained from the remaining ten centres from the first year's crop are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lbs. per acre.		Increase in lbs per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mylliem ...	U Jawoon ...	444	389	55
2	Umyngka ...	U Thon ...	790	637	153
3	Khlihtyrshi ...	U Tram Dkhar...	448	352	96
4	Pynthorlangtein ...	U Dabid ...	385	186	179
5	Umlene...	U Sing ...	489	363	126
6	Mawphlang ...	U Manik ...	382	296	86
7	Demthring ...	U Kat ...	306	255	51
8	Jalong ...	U Jata ...	487	348	129
9	Shyrmang ...	U Suna ...	400	224	176
10	Bymbai...	U Doloi ...	640	239	351
11	Mawstem ...	Ka Bi ...	...	...	Destroyed by cattle.
12	Umpyut ...	U Rang ...	...	...	The crops were mixed up.
Average yield per acre.			475	334	141

As might be expected, the effect of bonemeal on dry land paddy is not so marked in the year of application, as it is in the case of wet-land paddy. From the average results obtained in these ten

demonstrations it will be seen that 247 lbs bonemeal has produced an extra crop of 141 lbs. of grain. This is not sufficient to pay the initial cost of manure, however it is proposed to weigh the produce for two more years.

*Second year demonstration.*—The 15 centres commenced in 1917, of which the first year's results appeared in the report of last year, were kept under observation for the second year.

At eight centres the owners of the lands on which demonstrations were made were unwilling to continue the demonstrations, as little effect was seen on the first crop. The results obtained from the remaining seven centres for the second year are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mawroh ...	Saba Roy ...	42	336	84
2	Marbiau ...	Kpa U Hamu ...	394	370	24
3	Mylham ...	Ka Jim ...	548	389	151
4	Umjajao ...	U Hon ...	498	340	158
5	Langlibun ...	U Sahon ...	506	372	134
6	Pamra ...	U Thma ...	591	278	113
7	Mihmyntloo ...	U Muni ...	434	290	104
		Average yield per acre.	454	345	109

From the above figures, and taking the average results obtained from these demonstrations for the first and second year, it will be found that 247 lbs. of bonemeal produced an extra crop of 351 lbs. of grain, which is not sufficient to pay the initial cost of the manure. Should no better results be obtained from future trials, it will be hopeless to expect cultivators to use manure which will not repay its cost even in the second year.

In order that definite information may be gained it is intended that these trials shall be repeated in the following year.

As reported last year, at one centre in each of Shillong, Mauphlung and Jowai circles, a former demonstration was redressed with bonemeal. These demonstrations were manured with bonemeal in 1914, and received no manure in the intervening years. The effect of this second dressing of bonemeal on the second year's crop will be seen from the accompanying table.

No.	Locality.	Cultivators.	Yield of grain in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plots.	Untreated plots.	
1	2	3	4	5	6
1	Shangpung ...	Smon Dhar ...	1,320	914	406
2	Umlyngka ...	Kpa Ka Kwai ...	2,019	1,634	385
3	Mairang ...	Kinie Ka Selina ...	1,590	1,063	527
	Average ...	...	1,643	1,203	440

These results indicate that a second dressing of bonemeal, applied three years after the first dressing, will give a profitable return. The average total increase obtained in the first and second year from the second application was 747 lbs. Valuing the grain at Rs. 3 per maund and the bonemeal at Rs. 4-8, the net profit per acre works out at Rs. 14-8-0, and it is expected that an additional increase may be obtained in the third year also.

3. *Bone-crushing operations and bonemeal distribution.*—The total receipt of raw bones during the year was 10·10 tons. From this 6·32 tons were ground and 5·67 tons of bonemeal were produced. During the year a consignment of 40·36 tons was purchased in Calcutta and brought to Shillong and Jowai: thus making a supply of 46·03 tons of bonemeal available for distribution in the Hills Districts.

This was distributed as follows :—

	Tons.
Used at the Upper Shillong Farm ...	·80
For demonstrations in the Hills ...	·56
Exchanged for raw bones ...	1·88

			Tons.
Sold at the Farm	...	...	2.49
Sold at Shillong	...	...	10.78
Sold at Jowai	...	...	29.19
Sold to Honorary correspondents	...	...	22
			<hr/>
			42.68
Balance available at the farm			11
			<hr/>
Total	...	...	46.03

This quantity of 42½ tons, or approximately 1,200 maunds of bonemeal was sold to cultivators in the Hills Districts during the year at an average price of almost Rs. 5 per maund.

The importance of the work may be realized when it is stated that the cultivators paid in cash, a price which covered all expenses including cost price at Calcutta, all freight charges, and a small profit to the person who acted as agents for our Department, in transporting and retailing the manure. It speaks volumes for the integrity of the Hill people that there were no bad debts throughout.

The greater part of the material had to be brought by country boat from the Railway station at Sylhet to the foot of the hills, a distance of 40 miles or so—and then carried by manual labour for over 30 miles up the hills to Jowai, which was the main centre of distribution.

The Agricultural Inspector, U Harry Singh, exhibited great energy and resourcefulness in getting this part of the work done promptly and at reasonable rates. Had it not been for his exertions it would have been impossible to carry through the business on a self-supporting basis.

Credit is also due to the enterprising Calcutta firm which supplied the manure on a few months credit. If this help had not been given it would have been difficult, if not impossible, to distribute such a large quantity.

4. *Potato growing*.—During the year under report, depôts for the sale of seed potatoes were opened at 5 centres, viz :—

			Quantity of potatoes sold.
			Tons.
(1) Marbisu	...	...	2.20
(2) Lad Mawphlang	...	...	1.03
(3) Dumptep	...	...	1.14
(4) Jowai ..	...	...	.37
(5) Shillong	...	...	.44
			<hr/>
Total	...	...	5.18

Demonstrations were carried out in fourteen centres in the districts. Three demonstrations were arranged in each of Shillong, Mawphlang and Umran circles and 5 in the Jowai subdivision, where this crop is not much cultivated. One maund of seed potatoes was planted at each centre with the following results:—

No.	Locality.	Name of cultivator.	Yield in lb. per 1 md. seed.
1	2	3	4
<i>(Summer crop, Jowai Circle.)</i>			
1	Nongbah ...	U Rang ...	1,280
2	Mihmyntoloo ...	Jawain ...	1,010
3	Demthring ...	U Kat Lamong ...	650
4	Khlibtyrsbi ...	U Elija ...	800
5	Mawpynt ...	U Iangiangti ...	The crop was destroyed by wild pigs.
<i>(Summer crop, Shillong Circle.)</i>			
1	Mawlyngkneng ...	U Kumar ...	520
2	Umjijoa ...	U Soh ...	640
3	Cherra ...	Eljokisore ...	360
<i>(Summer crop, Mawphlang Circle.)</i>			
1	Mawphu ...	Tharai ...	320
2	Mawnai ...	Bidor Singh ...	604
3	Jakum ...	Kison Singh ...	690
<i>(Winter crop, Umran Circle.)</i>			
1	Nongpoh ...	Nogen ...	292
2	Ditto ...	Basir Ahmed ...	180
3	Lumpyngling ...	Himmoney ...	Destroyed by cattle.

The results are promising, especially in the Bhoi country and Jowai subdivision, and the demonstrations are being continued in the present year.

*Spraying with Bordeaux mixture.*—During the year there was no demand for spraying the potato crop as the weather was very unfavourable for spraying operations, and the cost of material was exceptionally high.



Although considerable damage is done each year to the potato crop by potato blight, the cultivators do not yet fully appreciate the value of spraying as a preventive, and the practice is not adopted to any great extent.

5. *Ploughing demonstrations*.—Ploughing demonstrations were carried out in four centres at Myllem, Umran, Barapani and Jowai by the Meston plough.

The cultivation done by one ploughing with this plough is as good as that done by 4 ploughings with the country plough. The results are encouraging and these demonstrations with the improved plough will be continued.

6. *Insect-pests*.—Rice pests, *viz.*, Rice fulgroid appeared in the district during the year. Remedial measures were taken by our staff and the ravages of these pests were successfully checked at six centres by the following means. The water in the affected field was covered with a film of kerosine oil, and the insects were then disturbed by drawing a rope or bamboo across the affected plants. When so disturbed these insects drop into the water and are quickly killed by the kerosine oil.

7. *Grafting and pruning of fruit trees*.—This work was continued as in the previous years, demonstrations being given by demonstrators from time to time on their tours. The following grafts were made in 24 villages :—

Oranges	...	...	Budded	...	242
Pears	...	...	"	...	169
Peaches	...	...	Grafted	...	144
Apples	...	...	"	...	50
Plums	...	...	"	...	83
Apricots	...	...	"	...	26
Total				...	714

Up to the present no signs of disease have appeared on the oranges so budded.

The following plants are being prepared by grafting at the Wahjain Tropical Plantation :—

Jamica orange	...	...	...	...	3
Natal "	...	...	...	...	3
Litchis	...	...	...	...	3
Mangoes	...	...	...	...	6
Total				...	15

Pruning of fruit trees was done in 17 gardens including 11 in Shillong circle and 2 in each of Umran, Jowai and Garo Hills.

8. *Supply of seeds, plants, etc.*—The following seeds, plants, etc., were distributed during the year:—

Garo cotton seed	...	...	18 lbs.
Spanish chestnut	...	...	4 „
Orange seed	...	...	2 „
Soybean seed	...	...	4 „
Paddy seed (from Mawsiat Khnam)	...	...	80 „
Maize (Nepali)	...	...	2 „
Arrowroot plants (from Mahadeo)	...	...	3 „
Coffee seed ( ditto )	...	...	8½ „
Sohiong seed	...	...	2 „
Mulberry seed	...	...	4 Oz.
Custard apple	...	...	1 „
Papaya	...	...	1 „
Seed of pepper (round)	...	...	4 „
Seeds of squash	...	...	24 „
Cuttings of Shillong pear	...	...	200 number.
Cuttings of grape vines	...	...	12 „
Ditto black pepper	...	...	6 „
Ditto plums	...	...	10 „
Ditto figs	...	...	12 „
Ditto peaches	...	...	100 „
Orange seedlings	...	...	2,213 „
Lime	...	...	500 „
Bitter orange	...	...	12 „
Plums ordinary	...	...	70 „
Pear grafts	...	...	21 „
Pineapple suckers (from Wahjain)	...	...	4,500 „

The following tools were supplied during the year:—

Morton ploughs	...	...	2
Hand spraying pump	...	...	1
Secateurs	...	...	2
Khasi kodals with sockets	...	...	3

9. *Pan disease.*—The Imperial Bacteriologist, Pusa, visited Shillong and Cherrapunji last year and procured diseased specimens of plants for further investigations but no report has yet been received.

10. The following Botanical specimens were supplied during the year :—

Plants of kse—pharai (pitcher plant *Nepenthes Khasiana*).

Ditto Sohlang thrait (*Ganelltheri Fragrantis Sima*).

Ditto Khario (*Pachycarpa*).

Ditto and seeds of Sohamthein (*Militia pulchra*).

Ditto of yellow variety of cotton.

Seven pieces of Khasi cloth made of yellow of cotton.

11. *Demonstrations in the Garo Hills*.—During the year potato demonstrations with winter crop were laid down at four centres. One maund of seed was used in each centre, and this was planted on approximately  $\frac{1}{10}$ -th of an acre. The yield were as follows :—

Locality.			Yield from 80 lbs. of seed.	Remarks.
1			2	3
			lbs.	
Duragiri	...	...	328	
Rongkhongiri	...	...	400	
Amindagiri	...	...	160	
Harigao	...	...	Nil	Destroyed by insects.

The demonstrations were promising on suitable localities and the work is being continued in the present year.

12. Demonstrations with Garo cotton have been carried out in three centres in the Jaintia Hills and in one centre at Nongpoh. The seed was received very late and failed to germinate, fresh demonstrations are being made in four centres, i.e., two in each of Jowai and Umran circles.

Demonstrations with local, well reputed paddy seed have been carried out at 5 centres in the Jowai subdivision, and the results obtained from 1 seer of seed used in each centre, are as follows :—

Jowai	...	...	Nil.	The place is too high and the crop did not ripen.
Nongjuri	...	...	72 lbs.	
Shangpung	...	...	44 "	
Nartiang	...	...	52 "	
Nongbah	...	...	28 "	

The demonstrations were promising on suitable localities; 25 seers of the seed has been distributed free during the present year.

13. *New demonstrations.*—Demonstrations with yellow cotton are being made in 3 centres in Garo Hills.

Demonstrations with Khasi paddy seeds for hill and wet lands are being made in 6 centres in the Garo Hills.

Demonstrations with groundnut are being made in 2 centres in each of Shillong, Mawphlang, Umrán and Jowai circles and in 4 centres in Garo Hills.

The services of the Demonstrator in charge of the Umrán circle were dispensed with from October 1917.

CAMP KABIMGANJ :

J. W. MCKAY,

The 8th August 1918.

*Deputy Director of Agriculture,  
Surma Valley and Hill Districts.*

REPORT ON AGRICULTURAL DEMONSTRATIONS  
THE SURMA VALLEY FOR THE YEAR ENDING  
THE 30TH JUNE 1918.

*Staff.*—The demonstration staff in the valley consists of one Superintendent, two Agricultural Inspectors and seven Agricultural Demonstrators, of which one was appointed in the last quarter of the year. We have now two Demonstrators in Soma Sylhet, one for each of the remaining subdivisions except Sunamganj, one for the Cachar plains, and one for the North Cachar Hills.

The Superintendent, Mr. L. Barthakur, was on tour for 241 days, Babu Binod Bihari Das, Agricultural Inspector, Sylhet, for 261 days and Mr. L. M. Das, Agricultural Inspector, Karimgarh and Cachar for 175 days.

The number of touring days of the Agricultural Demonstrators varied from 105 to 241 days.

2. *Kinds of demonstrations.*—The main items of demonstration were as follows:—

- (a) Paddy manurial tests,
- (b) Trial with superior varieties of paddy,
- (c) Introduction of improved sugarcanes and 3 roller mills and shallow *gur* boiling pans,
- (d) Jute demonstrations—variety and manurial,
- (e) Introduction of Shillong seed potatoes,
- (f) Trials with new crops :  
Jowar for fodder, groundnuts, wheat, barley, castor, khesari, gram, mosoori, Assam mustard (large grained), linseed (large grained etc.),
- (g) Demonstrations in the North Cachar Hills,
- (h) Trials with Meston plough and Planet Junior Hoe,
- (i) Miscellaneous: Conservation of cattle manure in covered pits, preparation of water hyacinth ash.

3. Paddy manurial demonstrations laid down in 1917 comprised the following kinds:—

- (a) Bonemeal used alone,
- (b) Bonemeal with crushed

- (c) Oilcake alone,
- (d) Oilcake with bonemeal,
- (e) Green manuring with Dhaincha,
- (f) Dhaincha with bonemeal,
- (g) Dhaincha with crushed limestone.

Bonemeal was applied at the rate of 247 pounds (3 maunds) per acre, limestone at 823 pounds, oilcake at 494 pounds and dhaincha seed sown at the rate of 30 lbs. per acre. When conjointly used, bonemeal and oilcake were applied at half the above rates in Sylhet circle, while in Karimganj and Cachar circle they were used at full rates.

The average yield from each kind of manure and the costs are given in the following abstract:—

Kind of manures.	Karimganj and Cachar.				Sylhet.				Average value of manured crop.	Average cost.
	Number of Demonstrations.	Average increase in output.	Value of the increased crop.	Cost of manuring.	Number of Demonstrations.	Average increase in output.	Value of the increased crop.	Cost of manuring.		
1	2	3	4	5	6	7	8	9	10	11
		Pounds.	Rs. s. p.	Rs. s. p.		Pounds.	Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.
bonemeal ...	9	636	15 12 0	9 0 0	20	613	7 13 0	9 0 0	10 5 0	9 0 0
bonemeal and limestone	2	701	17 8 0	18 0 0	...	...	...	18 0 0	...	...
oilcake ...	2	76	1 14 0	12 0 0	6	329	8 3 0	12 0 0	6 6 0	12 6 0
oilcake and Bonemeal ...	2	474	11 13 0	21 0 0	7	466	11 0 0	10 8 0	11 8 0	12 12 0
dhaincha green manuring	9	468	11 11 0	1 12 0	3	150	3 12 0	1 12 0	9 11 0	1 12 0
dhaincha and bonemeal ...	7	305	7 7 0	10 12 0	7	278	6 16 0	10 12 0	7 5 0	10 12 0
dhaincha and lime ...	3	473	11 13 0	10 12 0	4	226	5 11 0	10 12 0	8 4 0	10 12 0

The above demonstrations were distributed over the following districts:—Duttagram, Tukurbazar, Lakshmipassa, Baraya, Jelalpur, Golapganj in North Sylhet, Shamshernagar, Srimangal and Tulaura in South Sylhet; Shaistaganj and Itakhola in Habiganj; Botalekl, Shabazpur and Kayesthagram in Karimganj, Lakhiur, Banskandi, Lakhirband and Boalipar in Cachar.

4. The residual effects of bonemeal applied in 1915 and 1916, and that of dhaincha green manuring given in 1916, were observed by weighing the crops produced in 1917 from the plots so treated.

The results will be found in the abstract which is now given :—

Details of Demonstrations.	Average yield of manured plot in 1917-18.	Average yield of manured plot in 1917-18.	Increase in 1917-18.	Value of the increased crop in 1917-18 at Rs. 2 per maund.	Previous increases.	Value of previous increases at Rs. 2 per maund.	Value of the total increase.	Cost of manuring.
1	2	3	4	5	6	7	8	9
	Pounds per Acre.			Rs. a. p.	Pounds per Acre.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Average of 10 bonemeal demonstrations laid down in 1916 in Karimganj district.	2,076	1,727	348	8 11 0	874	21 8 0	80 3 0	8 0 0
Average of 13 bonemeal demonstrations laid down in 1916 in Karimganj district.	2,631	2,254	427	10 9 0	479	17 15 0	28 8 0	9 0 0
Average of 7 bonemeal demonstrations laid down in 1916 in Sylhet centres.	1,632	1,436	196	4 14 0	600	22 8 0	27 6 0	9 0 0
Average of 2 dhaincha green manuring demonstrations laid down in 1916 in Karimganj district.	2,770	2,774	496	12 6 0	535	20 0 0	32 6 0	111 0

The above demonstrations were distributed over the following districts :—

Barlekha, Patharia, Chotalekha in Karimganj and Tukur bazar, Ganganagar and Khojarkhola in North Sylhet.

Owing to the low price which prevailed for paddy this year none of the manurial demonstrations have given sufficient profit in one season to justify the expenditure incurred. It will, however, be seen from the results of these demonstrations, which have been kept under observation for several years, that the first year's increase is by no means the whole advantage to be gained from the use of these manures. Bonemeal or dhaincha green manure

used either separately or jointly are pretty sure to leave a substantial profit in three years, during which the effects of these manure are likely to be noticeable in the crops.

5. With a view to introduce superior varieties of paddy, a number of tests were carried out in various centres. George *sail* introduced by Srijut Narain Baruah of Nakachari, Honorary correspondent of the Department, and Indra *sail* and Kandulia introduced by the Bengal Department were tried against the best local varieties. The results are as follows:—

	George Sail	Country Sail.	Indra Sail.	Country Sail.	Kandulia Sail.	Country Sail.	Remarks.
1	2	3	4	5	6	7	8
Yield in pounds per acre.							
Karimganj ... ..	2,003	1,638	1,841	2,203	2,304	2,308	
North Sylhet ... ..	...	...	1,455	1,447	1,075	916	
South Sylhet ... ..	...	...	2,499	2,215	1,208	1,170	
Cachar ... ..	2,706	1,708	2,028	...	1,685	...	

As indicated by the above figures these important varieties of paddy appear to behave differently under different soil and water conditions. Although on the average the improved varieties have given hopeful results, the yields are not sufficiently regular to justify a claim being made in favour of any particular variety, and therefore, with the object of throwing further light on the matter, a large number of fresh demonstrations are being organized for the present season.

6. *Sugarcane and sugar mills.*—Improved varieties of sugar-canes, e.g., Striped Mauritius, B147, and B376, were introduced into this valley for the first time in 1916 from Upper Assam. In that year 9,000 sets were distributed. Last year 15,000 sets were brought from the Kamrup Farm. For this year's distribution a supply of 12,000 sets was secured from Jorhat and Kamrup and some 3,500 sets were obtained from local cultivators in return for sets supplied to them last year. Wherever introduced, these canes have established their superiority over the local canes, and the demand for sets is rapidly increasing. But for the high



freight rates from the Assam Valley, a much larger number could have been usefully distributed this year. Apart from the heavy cost of transit there is always a considerable risk of damage to sets in the long railway journey, and we, therefore, intend as far as possible to meet the increased demand in the future by means of local supplies of sets.

To effect this we are distributing sets in larger number to cultivators, who undertake to return to us in the following year a number of sets equal to that given.

Crushing demonstrations were given at various places near Shamshernagar, Bhanugach, Barlekha and Silchar. The results of these demonstrations show that the three-roller iron sugar mills gave, on the average, some 20 per cent. greater extraction of juice than was produced by the wooden mills. Wherever tried these mills have successfully proved their superiority to the ordinary mills. These mills could not be sold at less than Rs. 75 each, which is a very considerable amount for the cultivator to put down at one time, nevertheless four of the improved three-roller sugarcane mills and two shallow *gur* boiling pans have been sold during the year.

7. *Jute demonstrations*.—Kakaya Bombai jute of the Bengal Agricultural Departments was introduced into Sylhet in 1916 and since then it has been rising in popularity in the southern part of the valley. Variety and manurial tests were organized in 1917 and their results, which are tabulated below, speak for themselves :—

Centre.	Average number of demonstrations.	Kakaya Bombai Jute.	Country Jute.	Average number of demonstrations.	Yield of bonemeal.	Yield of no manure plots.
1	2	3	4	5	6	7
Yield of fibre in pounds per acre.						
Itakhola (Surma) ...	8	1,564	1,305	3	1,293	1,109
Bejura ...	4	1,498	1,196	3	1,318	1,316
Shaistaganj ...	2	1,678	1,189	...	...	...
Ramnagar ...	2	2,121	1,408	...	...	...
Total ...	16	6,861	5,098	6	2,611	2,425
Average ...	...	1,600	1,276	...	1,305	1,212

Attempts to introduce Kakaya Bombai jute were made at other centres also, but, on account of the general fall in the price of jute last season, the advantage from growing the improved variety was not so apparent as in the abovementioned districts and little effect was produced in those places.

This year (1915) a number of variety tests and manurial demonstrations are being organized. For the purpose of popularising the improved jute seed a number of packets of Kakaya Bombai jute has been distributed throughout the district of Sylhet, and arrangements are being made for procuring a return of seeds equal to the quantity supplied.

8. *Introduction of Shillong potatoes for seed.*—During the year under report 120 maunds of Shillong seed potatoes was brought into the valley. Of this total quantity, 56 maunds were sold through Honorary correspondent, Babu Joy Nath Nandi of Bejura, 3 maunds supplied to Honorary correspondents, 52½ maunds distributed on demonstration account, and 6½ maunds lost through diage and rottag. In most of the places the demonstrations served the purpose of introduction only. Even those quantitative tests organized for testing the cropping power of Shillong seed potatoes against that of country and Bholaganj potatoes did not, owing to the general unfavourable character of the season, yield crops up to the average. Figures obtained from such demonstrations as were carried out under satisfactory conditions, go to show the superiority of the Shillong potatoes from every point of view. The following varieties were distributed, viz., Magnum Bonum, King of Potatoes, Windsor Castle and Up-to-date. The cultivators appear to favour King of Potatoes and Windsor Castle owing to the fact that they are more waxy when cooked than the other varieties.

The average of 26 demonstrations carried out at Sylhet Shamshernagar, Srimangal, Shaistaganj and Bejura shows an outturn of 4,246 pounds (53 maunds) per acre from the Shillong seed and of 3,476 pounds (43 maunds) per acre from the country seed. Owing to the unfavourable season and the consequent small crop, the financial returns were poor from both kinds but the advantage was somewhat in favour of the Shillong seed.

9. *Trials with new crops.*—(a) *Jowar for fodder.*—Fodder Jowar was tried and successfully grown at several places in 1917. The crop grew some 5 feet to 8 feet high and in one plot it attained a height of 10 feet to 12 feet. As jowar does not grow well under water-logged conditions, cultivators are only encouraged to attempt to grow it on the higher lands, such as banks of tanks, sides of teelas, etc.

(b) *Groundnuts*.—Groundnuts have been successfully tried in several centres in Habiganj, North Sylhet and Karimganj. The cultivators are taking kindly to this crop and there seems to be hopeful prospects for its expansion. The outturn was some 26 maunds per acre equal to 10—12 times the quantity of seed used. This crop is readily saleable at remunerative prices.

(c) Wheat, barley and oats were tried at different centres with moderate success. Some good crops were obtained by up-country people at Gangapur in Silchar and at Teliapara in South Sylhet. Pusa wheat gave better results than local wheat.

(d) Khesari, Mosoori and gram also were tried, but the very dry cold season was unfavourable for these crops, and only light yields were obtained.

(e) An attempt was made to introduce improved types of oil seeds—Assam mustard and a large-grained linseed from Calcutta were tried. The results are encouraging and the experiment will be repeated.

(f) *Gandhi sail*, a late variety of sail and Sachi among a very deep water *amon* paddy, both from the Dacca district, were tried but with little success.

10. With a view to introduce new varieties and new crops into the North Cachar Hills, a number of tests in various centres were carried out with the following :—

Shillong potatoes, Khasi maize, Garo cotton, soybean, Jowar and groundnut. Fresh demonstrations with the above are being carried out in the present year also, and in addition, arrangements are being made for carrying out some wet paddy demonstrations, in districts where this crop has not been much cultivated previously. One hundred orange seedlings from Sylhet were supplied free to a Naga Mauzadar and 100 more were sold to a Nepalee cultivator near the Haflong station.

11. Meston plough demonstrations were given at Fenchuganj, Salutikar, Shamshernagar, Barlekha and several other places. Some of the cultivators appear to appreciate this improved plough especially for their cold weather crops.

The " Planet Junior hoe " was successfully tried near Shaistaganj for inter-cultivation for the potato crop.

12. *Covered manure pits*—Cultivators are very slow to appreciate the utility of covered manure pits, and only a small number of pits has been prepared during the year under report.

13. *Water Hyacinth*.—Water Hyacinth introduced from the neighbouring districts of Bengal, is rapidly becoming a troublesome pest in the lower tracts of Habiganj and Sunamganj.

With a view to acquaint the people with the economic and agricultural value of the ash of this pest, weeds were collected and ash prepared at Bejura, Chhatia and Lakhai. A total quantity of 100 maunds was prepared under departmental supervision and a further quantity of 36 maunds was procured through cultivators. A portion of this stuff is being used for manurial trials, and a consignment of 70 maunds has been sent to Calcutta, in order to see whether or not it will be profitable for local people to undertake the preparation and sale of Hyacinth ash as a manure.

The experiment station of the Tea Association at Cinnamara and a few tea planters have kindly undertaken to test the manure during the present year. If the material can be prepared at a reasonable price it is possible that there may be a local demand for it as a tea manure.

SHILLONG,  
The 26th July 1918. }

J. W. MCKAY,  
*Deputy Director of Agriculture,  
Surma Valley and Hill Districts.*

## GLOSSARY.

Kharif ...	...	...	The rainy season.
Rabi ...	...	...	The cold season.
Batoon ...	...	...	The second year's sugarcane crop grown from plants put down in the previous year.
Aus ...	...	...	Autum rice.
Sail ...	...	...	Winter rice.
Asra ...	...	...	A shorts stemmed variety of deep water winter rice.
Dhaincha ...	...	...	Sesbania aculeata.
Cowpea ...	...	...	Vigna catieng.
Jowar ...	...	...	Andropogon sorghum var. vulgare.
Kalai ...	...	...	Phaseolus mung var. radiatus.
Khesari ...	...	...	Lathyrus sativus.
Musur ...	...	...	Lens esculenta.
Mung ...	...	...	Phaseolus mungo.
Gram ...	...	...	Cicer arietinum.
Coriander ...	...	...	Coriandrum sativum.
Radish ...	...	...	Raphanus sativus.
Rape ...	...	...	Brassica Campestris.
Matikalai ...	...	...	Phaseolus mungo var.
Kulthikalai ...	...	...	Dolichos biflorus.
Lucerne ...	...	...	Medicago sativa.
Wheat ...	...	...	Triticum vulgare.
Oats ...	...	...	Avena Sativa.
Sugarcane ...	...	...	Sacharum officinarum.
Beer seem ...	...	...	Trifolium alexandrinum.
Soy beans ...	...	...	Glycine hispida.
Paddy ...	...	...	Oriza sativa.
Indigo ...	...	...	Indigofera tinctoria.
Groundnuts ...	...	...	Arachis hypogæa.
Sunn Hemp ...	...	...	Crotalaria juncea.
Job's tears ...	...	...	Coir lachryma.
Raishan ...	...	...	Paspalum sanguinale.
Maund ...	...	...	32 $\frac{1}{2}$ ponnds.
Jhum ...	...	...	A system of cultivation consisting of paving and burning the surface.

